GAS JOURNAL, APRIL 17, 1940

VOL. 230 92nd YEAR No. 4013

TERMS OF SUBSCRIPTION—*United Kingdom and Ireland: Advance Rate, 35/- per annum; 18/- per half year. Credit Rate: 40/- per annum; 21/- per half year. Dominions and Colonies and United States: 35/- per annum, in advance. Other countries in the Postal Union, 40/- per annum, in advance. A copy of the "G.J." Calendar and Directory is presented to continuous subscribers.*

CLASSIFIED ADVERTISEMENTS—*Situations Wanted, 6d. a line (minimum 3/-, about 36 words). Situations Vacant, Plant for Sale and Wanted, Contracts, Public Notices, Educational, &c., 9d. a line. (minimum 4/6). Financial Notices, 1/- per line. Box Number, 6d. extra.* WALTER KING, LTD., *11, Bolt Court, Fleet Street, London, E.C.4. Telephone: Central 2236-7-8. Telegrams: Gasking, Fleet, London.*

Editorial Notes

Food Defence

THE Gas Industry's effort in connexion with the national Food Education Campaign received an auspicious send-off last Friday when the Minister of Food, Lord Woolton, was the principal guest at a luncheon at the Dorchester Hotel, London, over which Sir David Milne-Watson presided as Chairman of the British Gas Federation. A five-course lunch for some 450 persons might seem to the average German a strange method of launching a food economy campaign; but that is the advantage of living in Great Britain, and in any case he will not be allowed to know that there are quite enough unrationed foodstuffs here to supply such a lunch on an extremely satisfying scale, if not quite so epicurean as one expects in peacetime, without in the least disturbing the conscience of the chief controller of food as he sits in the place of honour.

We discussed last week the part which the Gas Industry is so well qualified to play in the national drive for the wise use of our food supplies and, particularly in view of the newly imposed drastic restrictions on paper, we cannot do better than refer our readers to our report of the function on later pages. The Industry, as Sir David explained, has some 11 million customers, 1,000 showrooms, 200 demonstration theatres, and 400 demonstrators. He pledged the power and the goodwill of the whole Industry behind this front line force to carry the message to the homes of the nation. The message, be it noted, is not that we must avoid waste because there is a shortage of food. It is, rather, that there are so few signs of food shortage that we are all liable to be careless, and carelessness in this direction is a gross waste of national effort.

The Industry will know how to proceed.

Oil From Coal

IN his Presidential Address to the Institution of Chemical Engineers, Mr. F. Heron Rogers certainly "let himself go" on the subject of the synthetic production of oil from coal. He pointed out that in 1938 importation of oils into this country—all importations, that is, petrol, paraffin, lubricants, gas and fuel oil, and wax—amounted to over a quarter of a ton per head of population, which oil purchases meant that £42,482,125 went out of the country. What a strong position this country would be in, he said, if out of its natural resources it could make itself independent of overseas oil supplies, and even had exportable surplus supplies. And, he added, *this it undoubtedly can do.* The italics are not ours.

Mr. Rogers led his audience "gently yet firmly to the ultimate perspective of the oil industry—namely, the synthetic aspect of production instead of production from natural oil resources." Our natural resource is coal, which, as everyone knows, could serve as raw material for the synthetic production of oils of all types by some such method as that developed to a thoroughly practical stage in the Fischer-Tropsch process. In certain other parts of the world, oil itself (in all its various forms) is the natural resource. Mr. Rogers remarked: "I am firmly of the opinion that in the years to come the entire development of this great necessity (*i.e.*, oil) of the human race will eventually pass into the hands of the chemist and the chemical engineer." But surely the products of the natural petroleum industry as we know them in the year 1940 are the outcome of the work undertaken by the petroleum chemist and the petroleum chemical engineer. Over many years the oil industry has appreciated the work of the skilled chemist and the skilled chemical engineer. It has backed this work up better, we think, than most other industries in this country and in others. It has picked its staffs with acumen, backed them up with understanding, and paid them well in cash. Had it not been for this policy—a policy pursued enthusiastically—the oil industry would not have been in the position it is in to-day. And it would have been in no position at all if the soothsayers of twenty-five years or so ago had been true prophets, because they prophesied a drying-up of natural oil resources, which simply has not taken place. The forebodings of twenty-five years back have not been proved sound, and we venture the opinion that gloomy prognostications current to-day will not in the event be fulfilled. New sources of natural oil will be tapped. This oil may be more expensive to obtain, but it may be relatively inexpensive to produce in comparison with the synthetic manufacture of oils from coal, which in this regard is a recalcitrant material.

The question may be asked why, if in normal circumstances natural oils can, as far as this country is concerned, be secured from external sources in abundant supply, and cheaply, the practice should be on an inferior plane to that of the synthesis of oils from coal. Our view has been that, because in peacetime of the overwhelming economic advantages of importing oil, the practice of importation was very sound indeed. It conferred benefits all round, to the consumer, of course, and not least to the National Exchequer. The tax on imported oil has played no insignificant part in relieving the financial burdens of this country. And too often it is forgotten that the Government has given a long-term guarantee of the freedom of 8d. a gallon duty on home produced petrol.

Have Fundamental Principles Changed ?

We have our hydrogenation plant at Billingham for the production of oil from coal; and a very good thing it is that we have it. Concerning its economics we know little, and—a few people "in the know" apart—we think that few chemists and chemical engineers are in better plight than ourselves in this regard. This is one method, and one method only, of producing oil from coal, and it has its limitations. Concerning end products, we think the synthetic process such as that of the Fischer-Tropsch has more fascination and more possibilities, and we should like to see in operation a large-scale synthetic plant in this country. The Falmouth Committee, in its 1938 Report, to which many references have since been made in these columns, stated: "The Committee consider that it would be of considerable advantage if the establishment of a plant to work the Fischer process, and designed for the production of not less than 20,000-30,000 tons of primary products per annum, could be secured. They hope that, with the extension of the guaranteed preference, one or more industrial concerns may be induced to undertake the erection of such a plant. But if financial assistance is requested from the Government, the Committee recommend that such assistance should be limited to sums required for special items of research work which, by agreement with the Department of Scientific and Industrial Research, can be recommended as being of national interest." We regard it as unfortunate that nothing was done about the erection of such a unit, but it cannot be said that the Committee was particularly enthusiastic and positive in its recommendation.

Though the war has brought a new focus to bear on the whole question of the production of oil from indigenous materials, it cannot have altered fundamental principles concerning the right use of natural petroleum products and their substitution by synthetic materials made from coal. Of course, an artificial atmosphere has been created, and many a peacetime argument has had to go by the board. Economic values are turned inside out; after the war they will tend to right themselves, though doubtless on a very different plane.

Self-Sufficiency—at What Price?

Now Mr. Rogers, in his Address, went all out for the making of this country entirely independent of imported oil supplies—in fact, as we mentioned earlier, of making it an exporting oil industry, this via the synthesis of oils from coal. In the synthetic process, 9 tons of coal are needed per ton of petrol produced. "Our coal mining industry," he said, "raises 260,000,000 tons of coal per annum, and if all this were turned into oil products it would give us 47,000,000 tons of oil products per annum, or three and a half times more than we require. Hence we might heat and light our population through a pipeline and have a large surplus for export." Which is a plan which, we hope, will not mature while cheap supplies of natural oil are available for the benefit of the community, when gas, coke, and the other derivatives of carbonization can be made available by a proved economic process which conserves the energy of coal and utilizes it to the best possible advantage, and when electricity produced from coal is a form of energy essential to national life.

We do not wish our attitude to be misinterpreted. We are as keen as anyone else to see the synthesis of oil from coal brought to an economic solution. All we ask for is a sense of perspective in the matter. What capital would be entailed if 260,000,000 tons of coal in this country were by synthesis converted into oils of various qualities? What would be the running charges and the depreciation costs of plant? Would it be in the best national interest to use 5½ tons of our greatest asset in producing 1 ton of oils? In asking these questions we hold firmly to our view that we must not lag behind any others in our knowledge of the means of obtaining oil from coal; and the case for establishing a full-scale synthetic plant appears to us to need no argument in its favour, irrespective of whether such a unit would or would not be a "paying proposition."

Storage of Coal

During the coming months, particularly in view of the experiences of last winter, the policy of gas undertakings generally will be to stock as much suitable coal as they can obtain. This will, of course, entail extra handling costs for putting the coal into and taking it out of stock, but the Gas Industry's aim is to ensure a continuous supply of gas at all times and under all conditions, and in spite of the great difficulties imposed by the abnormal weather last winter, this the Industry was able to do, thanks very largely to the stocks of coke which it had available for the manufacture of water gas. Stocks of coke are not now a prominent feature at works of gas undertakings. There is also another aspect of putting coal into stock and taking it out again for gas manufacture at a subsequent date, and that is the effect of weathering of coal in storage. Of late we have heard much on this subject, notably the Joint Communication by Mr. Jamieson, of Edinburgh, and Mr. Skilling, of the Fuel Research Board, given at a special meeting of The Institution of Gas Engineers a year ago. This Paper reported the results of an investigation carried out over a period of 3½ years on the weathering of low-caking coals, and the results have been the subject of comment in many quarters, and also in these columns.

The results of the work, too, formed the basis of the Paper by Mr. D. D. Melvin, of Edinburgh, at the meeting this month of the North British Association of Gas Managers. The Paper is apposite at this juncture. It was published in full in last week's "Journal," and our report of the discussion on it will be found in our issue to-day. The Author stated that normally —*i.e.*, under peacetime conditions—Scottish gas undertakings have in stock about 250,000 tons of coal (coal, by the way, particularly susceptible to weathering). To-day this figure, we suggest, must be less, and the practice of stocking coals for long periods and then re-claiming with existing handling plant deteriorated raw material will have to be reviewed and probably revised. Acting on the long view, installation of plant for the expeditious removal of coal which has been placed temporarily in stock may prove the most economical solution for the handling of coals such as those commonly carbonized in Scotland, which are so prone to deterioration on storage. It may be, said Mr. Melvin, "that influences will be brought to bear in the near future by which stocking and withdrawal from stock may become part and parcel of our carbonization practice." We think this likely; it would aid flexibility under adverse conditions, and this implies smooth running at the lowest cost—that is, with high-priced coal—in the favourable circumstances which may ensue on the winning by the Allies of the present war. There may be those who envisage a return to conditions, say, in 1944, when deterioration over a number of years of a few thousand tons of gas-making coal held in stock could be regarded as of minor concern in the ultimate assessment of the cost of gas production. To us this view seems to verge on the optimistic.

Let us look ahead. Would it be more economical to install permanent plant to handle coal into and out of stock yards? Would it be good to redesign our works as the opportunity arose for this purpose, to stock definite types of coal only, to consider the adoption of alternative methods of gas production for the period of the year when the output was above the average? These questions were asked, but not answered by Mr. Melvin. We are of the opinion that the results of the Edinburgh investigations on the weathering of coal point to the desirability of stocking definite types, and that if appropriate types are selected small difficulties will be experienced.

Low-caking coals do not "weather" well over prolonged periods. Changes occur quickly when such coals are stored, and their net effect when these coals are carbonized (semi-gasified) in continuous vertical retorts is disastrous to the economics of gaseous therm production. Not least important is the effect of stored Scottish coals on coke revenue, which, as everyone knows, plays an important part in producing gas cheaply.

Pessimism and Optimism

Mr. MELVIN is frank enough about the disastrous results of storing the weakly-caking coals carbonized (or, we suggest, semi-gasified to produce relatively low calorific value gas) in continuous vertical retorts. The result of stocking, he said, "is known to our cost." And why? Loss of caking power is reflected "in the speeding up of throughput, alteration in calorific value, and the production of *inferior and smaller coke*." The italics, for which we are responsible, may mean little. We may, perhaps, be forgiven for quoting yet further from what we consider the most significant paragraph of Mr. Melvin's Paper: "This coke passes to the producer, which on account of its design is possibly unsuited to small coke, carbonization temperatures are affected, and the whole schedule of retorting operations is upset, while saleable coke is immediately reduced and breeze accumulates. This small coke also influences the production of carburetted or blue water gas where such plants are in use, and it is estimated the output of a plant can be halved by using unsuitably sized coke—just at a time when the plant is most required." Is this a cry from the depths by one who appreciates the influence of coke quality on the economics of gas manufacture as viewed through the circumscribed ambit of works practice?

Mr. Melvin gives us the impression that the "normal" stocking of 250,000 tons of weakly-caking coal by Scottish gas undertakings is not particularly beneficial to the close economical working of any individual gas undertaking north of the Border—*i.e.*, viewed from works practice. Works practice is, however, not something in itself; it is part of a whole. What about the possible and attainable revenue from the domestic, the commercial, and the industrial consumer of appropriate-grade coke? That, to our mind, influences gas-making costs, and it is an aspect given short shrift in Mr. Melvin's excellent works-cum-research Paper. The Author seems to strike a melancholy note when he avers that "if an all coal-gas policy is to be pursued, the financial inducement for stocking coal in the slack season for use in the winter months must be substantial to compensate for handling plant, labour, depreciation, irregularities in its use, and effects on normal working." Maybe Mr. Melvin cares not for the burden of selling in the right quarters coke of the right quality. We think that with co-operative effort the "burden" would be found to be a buoy in wartime and a salvation in future times of peace.

Comfort for Victory

Many are the suggestions that have been put forward for assisting in "winning the war," some, of course, of wider appeal than others. "Dig for victory" must be sound advice to those who are able to dig, and so must be "Save for victory" to all who are able to save. No doubt, too, there are many of us who would advantage ourselves, as well as do something to assist the country, by paying heed to the exhortation to "Eat less to win the war," though to some of the less fortunate in the community the advice may appear a trifle redundant. The same "economic expert" who is credited with the assertion that, "if we can save 10% in food consumption, it will be an important contribution to exchange capacity and shipping space, and a valuable addition to our fighting power," would possibly agree that if we could save 20% the "contribution" would be even more important—but at what cost? For our own part, we feel that quite as sound advice, to the people as a whole, is contained in the remark made by Dr. Harold Mason from the Chair, at the meeting of the Leamington Priors Gas Company, that: "When people are working longer and perhaps irregular hours, the extra comfort and convenience which gas appliances provide will aid in maintaining that personal efficiency necessary to win the war."

Personal

The Directors of William Sugg & Co., Ltd., announce the appointment of Mr. W. T. MATTOCK as General Manager and Mr. P. CRAWFORD SUGG as Assistant General Manager. Both these gentlemen continue to act as members of the Board of Directors.

* * *

Mr. JOHN MCPARTLAND has been appointed Manager of the Bray (County Wicklow) works of the Alliance and Dublin Consumers Gas Company, in succession to the late Mr. John Byrne. Mr. McPartland has been in the service of the Company, at Dun Laoghaire and Dublin, for over thirty years.

* * *

Mr. J. TREACY, Manager of the Fermoy Gas Company, has been appointed to the Managership of the Queenstown Gas Company.

* * *

On his retirement from the position of Manager of the Waterford Gas Company, Mr. F. J. EDMONDS was presented with a canteen of cutlery by the staff.

* * *

Mr. WILLIAM BROWN, who is retiring from the post of Gas Engineer and Manager at Burntisland, was presented recently with a silver-mounted umbrella from the Gas Managers of Kirkcaldy, Kinghorn, Markinch, and Leslie. These undertakings are linked together for A.R.P. purposes, and the presentation took place following an A.R.P. demonstration in connexion with gas mains at Kirkcaldy. Mr. J. M. Dow, Engineer and Manager to the Kirkcaldy Gas Department, handed over the gift.

* * *

After 39 years' service, Mr. GEORGE LIMBERT, Distribution Inspector to the Loughborough Corporation Gas Department, has retired on superannuation. At an informal gathering to mark his retirement, Mr. Limbert was presented by Mr. L. P. Ingram, Engineer and Manager, with a fireside chair which had been subscribed for by members of the staff and workmen.

* * *

Mr. R. WOODWARD, Engineering Assistant to the Leicester City Gas Department, has been appointed Engineer, Manager, and Secretary of the Newhaven Gas and Coke Company, and takes up his new duties at an early date. He has been in the service of Leicester Gas Department for the past 14 years.

* * *

Mr. MAURICE SMITH, for many years Assistant Engineer of the Colchester Gas Company, has been appointed Engineer and Manager of the Company in succession to Mr. W. W. Townsend who died in January last.

Obituary

The death has taken place at the age of 63, of Mr. CHARLES ANDERSON, at the Addenbrooke's Hospital, Cambridge. For over 40 years, he was connected with the Whittlesey Gas-Works, for the last 30 years as Manager. He was a member of the local Fuel Advisory Committee.

* * *

Mr. ARTHUR MERCER, late Manager of Messrs. Sawer & Purves, died at his residence at Southport on April 7. Mr. Mercer came from Alder & Mackay to Sawer & Purves in 1897 and was Manager from that time until he retired on pension six years ago. He leaves a widow, one son, and three daughters, all of whom are married. His elder son was killed in the Dardanelles during the last war.

* * *

Flying Officer NIGEL STUART GRAEME, who had been Assistant Sales Representative in Scotland for British Timken, Ltd., the bearing manufacturers, from September, 1938, until the outbreak of war, has been killed in an aircraft accident in France.

Flying Officer Graeme, who was a B.A., was the son of Colonel and Mrs. J. A. Graeme, of Farnborough, Hants. He joined British Timken, Ltd., in 1937 and passed through the works and the Technical Department before taking up his position in Scotland.

* * *

Mr. JAMES COOPER, a former Chairman of the Folkestone Gas and Coke Company, and a member of the Board since 1904, died on April 1, aged 86.

Letters to the Editor

Ice in Gasholder Tanks

SIR,—In Mr. Milbourne's description of Hope's Experiment, he states that "ice will always be found to have formed first at the top surface of the water in such vessels, while the sides will be free." With regard to the latter part of his statement, may I inform him of the following case?

During the severe weather of last winter, ice formation took place in the tank of a certain gasholder in such a fashion that when the surface ice was broken, the ice on the inner sides of the tank was lifted out in the form of huge icicles. This, I think, repudiates the above statement of Mr. Milbourne's and corroborates Dr. Foxwell's theory of fluid flow.

While Mr. Smith's suggestion of grounding the outer lift during severe weather to form an annular space between the tank and outer lift, and so act as an insulator, is, perhaps, sound in theory, other circumstances prevent it becoming practical. Giving due consideration to the necessity of continuity of gas supply, we see that in keeping the outer lift grounded during severe weather, when output of gas is increased, we lose a good proportion of the holder capacity. When the conditions are severe, ample reserve of gas is essential to meet rapidly fluctuating demands of gas. In the case of works with inadequate storage it is simply inviting disaster to keep the outer lift grounded. Thus, it appears to me that Mr. Smith's suggestion is impracticable.

Yours, &c.,

E. I. MESSENGER.

Gas-Works,
Workington.
April 14, 1940.

SIR,—I have read with great interest the criticism of Mr. S. M. Milbourne's article on "The Maintenance of Water Sealed Holders During Severe Weather Conditions," and the Author's replies.

Frankly, I am not enamoured of any of the five methods suggested by Mr. Milbourne. His first scheme of application of steam under the bottom curb of the holder appears to be the best, but this severely restricts the use of the holder, and quite a number of gas undertakings have difficulty in keeping their holders full when the weather is most severe.

I am inclined to agree with Dr. G. E. Foxwell that the solution is steam anti-freezers; but can Dr. Foxwell tell us, to quote his own words, "the *correct* number of anti-freezers of *proper* design" to install before the frost comes? This will depend upon the size of the holder, and I suggest that for the purpose of discussion, a three-lift spiral gasholder of 1 million cu.ft. capacity, of normal proportions, in steel tank above ground, would be a suitable size. With this information, I feel that we should be getting somewhere.

The suggestion of Mr. J. C. K. Blafry regarding Canadian practice is an excellent one, and I trust that results will accrue from this source, which will enable us to be trouble-free in this respect during the severest of winters.

Yours, &c.,

W. R. GARRETT,
A.M.I.Struct.E., Assoc.M.Inst.C.E.

62, Montbelle Road,
New Eltham, S.E.9.
April 8, 1940.

National Gas Council

Central Executive Board Meeting

A meeting of the Central Executive Board of the National Gas Council was held at Gas Industry House, 1, Grosvenor Place, S.W.1, on Tuesday, April 9. Pending the arrival of Sir David Milne-Watson, the Chair was taken by Mr. Frank H. Jones, M.Inst.C.E., M.I.Mech.E., J.P. (Vice-Chairman).

It was with the deepest regret that the sudden death was reported of Mr. W. B. Woodhouse, who had acted as Chairman of the Council of the Conjoint Conference of Public Utility Associations for many years, both in respect of the Electricity Interests and also as the nominee of the National Gas Council. It was felt that his death would leave a gap that it would be difficult to fill. A letter of condolence had been sent by the Council to Mrs. Woodhouse.

Mr. W. J. Sandeman, Chairman of the Executive Committee of the British Commercial Gas Association, was unanimously co-opted a member of the Central Executive Board.

Defence (Gas Charges) Order dated March 15, 1940.—It was reported that certain drafting amendments to this Order had been accepted by the Board of Trade, and that the Order when published had been circulated to the Industry. In brief, the Defence (Gas Charges) Order, 1939, was made applicable in cases where the net cost to undertakers of the coal and oil used by them in the manufacture of gas had increased.

War Damage to Property.—Mr. T. Hardie and Mr. A. W. Smith were appointed to represent the gas interests upon the deputation from the Conjoint Conference of Public Utility Associations that is to wait upon the Treasury for the purpose of ascertaining their intentions in connexion with the question of war damage to public utility undertakers.

Rating.—A Report was presented with regard to the position that had been created by reason of the fact that the Rating Authorities of Kent had made new proposals regarding the assessment of public utility undertakings.

Income-Tax—Negotiations with the Inland Revenue.—It was stated that, following upon the successful termination of negotiations reported at the previous meeting of the Board, the Negotiating sub-Committee of the Income-Tax Committee of the Council had again met the Inland Revenue Officials on March 21 with regard to outstanding points of a minor nature, and after a full discussion the Inland Revenue Authorities had promised to forward to the Council their views in writing.

British Gas Federation.—Arrangements were reported for the holding of an Inaugural Luncheon for the purpose of co-operating with the Ministry of Food in connexion with the Food Education Campaign, to be held at the Dorchester Hotel, Park Lane, W.1, on Friday, April 12. Lord Woolton, the Minister of Food, and Lady Woolton had indicated their intention of being present. Acceptances had also been received from other representatives of the Government and important guests. It was hoped that as many members of the Board as possible would attend.

Constitution and Rules—Office of Joint Hon. Secretary.—A Resolution drafted by the Council's Solicitor, Mr. S. E. Cash, providing for the abolition of the office of Joint Hon. Secretary, was approved for submission at a Special General Meeting of the Council to be held on June 5 next, when the Constitution and Rules would be amended to make this Resolution effective.

Coal

(a) Demurrage.—A report had been circulated to the members of the Board, containing the announcement made on March 13 by Mr. R. H. Bernays, M.P. (Parliamentary Secretary, Ministry of Transport) in the House of Commons to the effect that the Ministry, following the advice received from the Railway Executive Committee, had decided that any demurrage charges incurred between Dec. 18, 1939, when the new charges came into operation, and Feb. 29, 1940, should be remitted.

(b) General Position—Tabulation of Returns.—It was reported that the returns to the questionnaire sent by the Council to all gas undertakings, in conformity with an arrangement made by the Conjoint Conference of Public Utility Associations and the Mines Department, with regard to the undertakings' requirements for the six months April/September of this year, had been received and tabulated and sent to the Mines Department.

It was reported that, although the general coal position had improved considerably, it was still highly unsatisfactory, a very large number of undertakings continuing to draw from stock.

A resolution from the Midland Commercial Gas Association was submitted, drawing attention to the very serious position of gas undertakings in their area; and it was decided to forward this resolution to the new Coal Production Council set up by the Government under the Chairmanship of Lord Portal.

The next meeting of the Board will be held at Gas Industry House on Tuesday, May 7, at 2.30 p.m.

News of the Week

A Final Dividend of 3% (actual), less income-tax, for the year ended Dec. 31, 1939, making a total dividend of 5% for the year, is recommended by the Board of the South-Western Gas and Water Corporation, Ltd.

Notice is Given by the Sutton-in-Ashfield Urban District Council that as from July 20, 1940, they intend to supply gas of a calorific value of 500 B.Th.U. (gross) per cu.ft. in lieu of the calorific value of 475 B.Th.U. supplied in the past.

Businesses Evacuated when war broke out are still coming back to London in considerable numbers. Among the most recent is the Vacuum Oil Company, whose sale staff returned to Caxton House, Westminster, on Monday, from Ottershaw Park, Chertsey.

At a Further Conference of Tyneside local authorities on the Newcastle-upon-Tyne and Gateshead Gas Company's Bill, now before Parliament, it was decided to continue the opposition to the Bill with a view to obtaining a clause providing protection in the fixing of basic and differential prices.

A New Department of Light has been formed at the National Physical Laboratory to comprise the former Optics Division of the Physics Department and the Photometry Division of the Electricity Department. Mr. T. Smith, F.R.S., has been appointed Superintendent of the new department as from April 1, 1940.

It was Announced at a meeting of the Plymouth Corporation Gas Committee last week that the Minister of Health had signified consent to the borrowing of £36,350 for stoves, meters, services, mains, sulphate of ammonia, and carburetted water gas plant. The Engineer and General Manager (Mr. F. Blackburn) reported that the output of gas during February showed an increase of 2.34% compared with the corresponding month of 1939.

In Spite of the Difficulties brought about by the war, the Editorial Committee of the Coke Oven Managers' Association have been able to produce the 1940 Edition of the Year Book at an early date. The volume runs to 369 pages of text, including index, and contains the transactions of the various Sections of the Association during the past year, and it should prove as useful and interesting in matters concerning the coking industry as its predecessors. It is published by Benn Brothers, Ltd., of Bouverie House, Fleet Street, E.C.4.

Moonlight has Acquired a New Significance since the start of the black-out, and it has become a common practice to study this aspect of the calendar when arranging evening engagements. The Rawlplug Co., Ltd., of Cromwell Road, S.W.7, has rendered a useful service to its friends by issuing a moonlight calendar which shows, in monthly coloured graphs, the hours of moonlight throughout 1940. In forwarding us specimens the Company states that it will be pleased to forward copies to readers who may be equally interested in the products which are advertised.

We Have Referred in our Editorial Notes to the Presidential Address of Mr. F. Heron Rogers at the annual meeting of the Institution of Chemical Engineers. The meeting was followed by a most enjoyable and well arranged luncheon at the Hotel Victoria, on which occasion Mr. Leslie Burgin, Minister of Supply, in responding to the toast "His Majesty's Ministers," remarked that the advance made in the last 25 years in chemical engineering filled them with amazement. It was, he said, now and in the next few weeks and months that pace would play the vital part, and he asked whether everyone yet had acquired the war stroke, whether anyone had any slack to take up. He begged the whole of industry to realize that the maximum contribution they could make was to increase the tempo of production.

The Audited Statement of Accounts of the Cardiff Gas Light and Coke Company Co-Partnership Committee for the year ended Dec. 31, 1939, shows that the amount available, including the balance brought from last year, provides a bonus at the rate of 3¼% on co-partners' wages and salaries, leaving a balance of £34 7s. 3d. to be carried forward to next year's accounts. Interest amounting to £669 14s. 5d. has been credited to co-partners' cash accounts—an increase of £11 19s. 6d. over the previous year. Deposits made in the co-partnership savings account during the year amounted to £2,406 17s. 11d.—a reduction of £19 13s. 3d. compared with last year. Cash withdrawals during the year amounted to £6,055 0s. 10d.—viz., £5,561 14s. 9d. from cash account balances and £493 6s. 1d. from trust accounts. Co-partners increased their stockholdings by £2,697 at a cost of £3,287 18s. The average cost per £100 stock, including stamp duty, was £121 18s.

According to the Report of Mansfield Gas Department, 32,729,000 cu.ft. of gas was sent out during February, which is an increase of 5,073,000 cu.ft. over the corresponding month last year. The re-lighting of a few street lamps accounts for a small part of the increase.

Members of The Institution of Gas Engineers will be welcome at a Meeting of the Institute of Fuel to be held in the Connaught Rooms, Great Queen Street, London, W.C.2, on Thursday, April 25, at 6 p.m., when a Paper will be presented by Mr. J. N. Dundas Heenan on "Some Food for Thought in Steam Plant Design," which will be followed by a discussion.

As a Result of a Prolonged Demonstration, the Borough of Grantham have instructed the Grantham Gas Company to instal 211 modified street lighting units in accordance with BS/ARP/37 Specification. These are in addition to 25 directional lamps which have been in use since the outbreak of war and which have proved of great value to motorists passing through the town during black-out hours.

An Ordinary Meeting of the Institution of Chemical Engineers will be held in the Rooms of the Geological Society, Burlington House, Piccadilly, W.1, on April 23, at 5.15 p.m. A Paper entitled "A Review of Certain Unit Processes," will be presented by Mr. J. C. Farrant. Members of The Institution of Gas Engineers (non-members of the Institution of Chemical Engineers) who would like to attend this Meeting must obtain a card of introduction. These cards may be obtained on application to either Mr. A. J. V. Underwood or Mr. M. B. Donald, the Institution of Chemical Engineers, 56, Victoria Street, S.W.1.

There was a Record Attendance at the annual supper and general meeting of the Swindon United Gas Company Sports and Social Club, at their Clubroom in Chapel Street, Swindon. Mr. C. H. Chester (Managing Director of the Company) presided and thanked the Directors for their interest in the Club; Mr. T. Medcalf replied. Mr. W. V. Claridge (Deputy General Manager of the Company) proposed a toast to the visitors. Before the meeting of the Sports Club, the business of the Company's Pension Fund was conducted by Mr. Chester (Secretary). The report for the year ended Dec. 31 last, was unanimously adopted. The accounts showed a balance of £9,869 13s. 7d. The fund started three years ago with "nothing in the kitty" and it had now reached the figure of nearly £10,000. During the past year the members had paid in a sum of £1,246.

Forthcoming Engagements

April.

18.—Midland Coke Association.—Annual General Meeting, Grand Hotel, Birmingham, 2.30 p.m.

19.—I.G.E.—Chairmen's Technical Committee, 2.30 p.m.

20.—Yorkshire Junior Association.—Short Paper Meeting at Shipley. Council Chamber, Town Hall, 2.30 p.m.

23.—W.G.C.—Annual General Meeting, Gas Industry House.

23.—Institution of Chemical Engineers.—Meeting at Burlington House, W.1, 5.15 p.m.

23.—Lancashire and District Coke Association.—Annual General Meeting, 38, Kennedy Street, Manchester, 11 a.m.

24.—I.G.E.—Library Committee, 2.30 p.m.

25.—Midland Association.—Annual General Meeting, Grand Hotel, Birmingham, 2.30 p.m.

25.—Institute of Fuel.—Meeting in Connaught Rooms, Great Queen Street, W.C.2. Paper by J. N. Dundas Heenan on "Steam Plant Design."

27.—Manchester and District Juniors.—Meeting at Stretford. Papers by J. C. Hogg on "Carbonizing of Stock Coal," and by H. Q. Marris on "Sales of Appliances in Wartime."

May

3.—North of England Association.—Annual Meeting at Newcastle.

6.—I.G.E.—Finance Committee, 1.45 p.m.; Membership Committee, 2.15 p.m.; General Purposes Committee, 3 p.m.

7.—N.G.C.—Central Executive Board, 2.30 p.m.

7.—I.G.E.—Council, 10 a.m.

June.

5.—N.G.C.—Annual General Meeting, May Fair Hotel, Berkeley Street, W.1, 2.30 p.m.

(The entry in last week's Forthcoming Engagements under date of April 15, relating to a B.C.G.A. Meeting of Members in the South Wales District, was inserted in error. This particular meeting, was held, of course, on March 15.)

Claim Against Hornsey Company Fails

Alleged Breach of Warranty

An action brought against the Hornsey Gas Company by Mr. James Reid-Webster, of Golders Green, was concluded before Mr. Justice Croom-Johnson in the Kings Bench Division of the High Court on April 11.

Mr. Reid-Webster claimed damages for alleged breach of warranty in connexion with the hire of gas heaters. His case was that in September, 1938, he took a lease of premises in Aylmer Parade, Hornsey, to carry on a ladies' gown shop, and, relying upon representations and advice from the Gas Company, he agreed to hire two gas heaters or radiators without flue ventilation. The heaters were installed in positions advised by an inspector of the Company, and it was alleged that they were not fit or suitable for the purpose of heating the premises.

Mr. Reid-Webster pleaded that the burning of the heaters caused the air to become so over-charged with moisture that it condensed on the walls, fittings, furniture, and stock-in-trade. Damage was thereby caused, and the premises were rendered unfit for his business. Customers who came for fittings, said Mr. Reid-Webster, complained that garments were damp. Sometimes blocks in the parquet flooring rose and in the end he was obliged to close the premises temporarily on Jan. 5, 1939.

The Gas Company denied that any of their employees made the representations or gave the advice alleged by Mr. Reid-Webster. It was also denied that any warranty was given. It was alleged that Mr. Reid-Webster was responsible for any damage caused because he stocked the shop too soon after it was built and did not allow the place to dry out properly by having the windows open with the heat on. The allegation was made that by having the radiators on with no windows open, damp in the mortar and woodwork was drawn out.

Evidence was given at length on both sides.

His Lordship, in giving judgment, said the shop in question was a lock-up shop. The plaintiff desired to have heating of his shop that would not need a flue and which would be satisfactory for the purpose of heating his shop. Nothing was said about the ventilation in the premises. The plaintiff had asked to be recommended a form of heating, and he now asked his Lordship whether there was a warranty that the radiators were the proper things to be installed and an implied condition that the radiators were reasonably fit for the purpose named. In his view and evidence his Lordship thought that the plaintiff was wrong in thinking the advice had been given him by an inspector of the Company. Later the plaintiff found his stock had been affected by damp, and the Gas Company then examined the radiators and found that they were functioning perfectly. There was no suggestion that the radiators were not in perfect order. The defendants' evidence was that their advice was never accepted by the plaintiff and that the plaintiff chose the radiators. He was satisfied that the plaintiff had proved no warranty and that there never was any warranty. He was not satisfied that the radiators were unsatisfactory. Plaintiff's claim failed as there was no warranty or breach of agreement. Judgment was given for the defendants with costs.

Gas Equipment for Darwen's New School

The reports of School Medical Officers throughout the country have revealed that in almost every elementary school there are debilitated, anæmic, malnourished, stunted, or weakly children—handicapped by physical infirmities which render them unable to receive reasonable benefit from their schooling. For such children the best possible treatment is that provided at an open-air school whose characteristic features are fresh air and sunlight, a proper and sufficient diet, a daily period of rest, practical lessons in health habits, and individual attention.

A school of this kind has recently been opened at Darwen—the Tullyallan Open Air School—and it is noteworthy that gas plays an important part in the organization.

Mr. T. Haworth, Engineer and General Manager of the Darwen Corporation Gas Department, tells us that the equipment in the model kitchen includes a "Eureka" New World double gas oven in "Rado" mottled enamel finish, complete with "Regulo" and gas match, a Stott hot cupboard and carving table with thermostatic control, a New World 10-gallon milk and porridge boiler, and a "Rotapan" steamer.

In the caretaker's quarters there is a "Talbot" gas cooker and a "Cleenamel" boiler, while in the school hall there is a large clothes-drying cabinet supplied by Messrs. Pratchitt Bros., Ltd., of Carlisle, and in the rest room a "Luma" gas heater. It is interesting to observe that this order follows on a similar one carried out twelve months ago at the new Darwen Grammar School.

Glasgow Coke Oven Gas Offer

Negotiations Continue

Negotiations are being continued in regard to the offer of William Dixon, Ltd., to supply surplus coke oven gas to the Glasgow Corporation. A draft agreement between the Corporation and the firm had been prepared, and it was hoped that it might be adjusted at a meeting of the special Corporation Committee on April 8. It was reported, however, that questions had arisen regarding the quantity, quality, and pressure of the gas, and it was decided that negotiations should be continued. Originally, the firm offered to supply 5 million cu.ft. of coke oven gas per day at a price less than the cost of manufacture of gas at the Corporation gas-works.

The Engineer and General Manager of the Gas Department (Mr. J. W. McLusky) advised acceptance of this offer, stating in his report that "by taking coke oven gas for a few years in the quantity and at the price offered the Department would be enabled to maintain supplies through a very uncertain and difficult period and in the most economical manner." He added that conditions for economical gas manufacture in their own plant would not improve as war conditions developed.

The Gas Department is in need of an expansion of its output capacity, and it was intended to develop the Provan Works to increase the capacity of the plant; but the necessary borrowing powers for this purpose have been withheld by the Government Department. The suggestion was made that the development might be postponed by a utilization of available coke oven gas from steelworks in the area. If the local authority is unable to proceed with the work at Provan and finds that coke oven gas is not obtainable in assured regular quantity the Gas Department will be in some difficulty, as production capacity is short of the extreme needs of a cold winter. It is estimated that the maximum daily demand next winter may be in the region of 40 million cu.ft., whereas the present output capacity of the municipal plant is not more than 32 million cu.ft.

Wartime Street Lighting by Gas

The Chislehurst and Sidcup U.D.C. have decided to adopt modified street lighting over a considerable area, as the result of a successful demonstration by the South Suburban Gas Company. The installation will consist of:

155 BS/ARP/37 Gas Conversion Units for the "London" lamps in all the first-class traffic routes.

278 for "Rochester" lamps in the second-class traffic routes.

299 for "Windsor" square lamps in certain residential roads.

In the part of the district within the area of supply of the South Metropolitan Gas Company, 56 gas conversion units will also be erected.

The fittings will be supplied by William Sugg & Co., Ltd., and the installation will be put into operation on Oct. 1.

Midland Association

Annual General Meeting

The Annual General Meeting of the Midland Association of Gas Engineers and Managers will be held at the Grand Hotel, Birmingham, at 2.30 p.m. on Thursday, April 25, prior to which there will be an informal luncheon, without speeches.

Following the ordinary business of the meeting, a Review of the Wear and Tear on Refractory Materials used in Gas Manufacture will be given by Mr. A. T. Green, F.I.C., Director of Research of the British Refractories Research Association, and Mr. T. F. E. Rhead, M.Sc., F.I.C., Chairman of the Joint Committee of the Gas Research Board and the British Refractories Research Association. The subject will be illustrated by lantern slides and samples of used and unused refractories.

Corrections

We regret we were misinformed when we stated on April 3 that a loan was being sought by the Ashton-under-Lyne Gas Committee. Mr. William Bennett asks us to state that this is not the case.

In last week's issue we stated that the Scottish Office had refused to sanction borrowing by the Motherwell and Wishaw Town Council of £35,000 for gas-works expenditure. Mr. William Kirk informs us, on April 11, that no decision has yet been reached by the Office on this sum.

Victory Through the Kitchen

"Front-Line Troops" at the Dorchester Hotel

One of John Bull's characteristics is that he can and will rise to the occasion in the hour of need, and with irresistible resourcefulness, if he is given the necessary lead. Such a lead was given at a Luncheon at the Dorchester Hotel, London, on April 12, by the Gas Industry, which, as a great public institution, has stepped into the breach to show John Bull's wife, with whom it is so closely in touch, how she, too, can play her part in her own kitchen in helping to win the war.

THE enthusiasm which was evident at the launching of the Industry's "How to be Fitter though Rationed" campaign must surely be a good omen for the success of the mission. The function, organized by the British Gas Federation, was attended by representatives of all sections of the Industry, including many cookery demonstrators from all parts of Britain who are to take a leading part in guiding the public along the road to "victory through the kitchen." In peacetime splendid work has been done by the Industry's Home Service in helping the public with cooking problems of all kinds, and now we are at war this work will be greatly intensified and extended in scope through the framework of the National Food Campaign.

The Luncheon at which Lord Woolton, Minister of Food, was principal guest, consisted entirely of unrationed foods—the chief dish being "fritto-misto," or in less poetic language, "offal," though Lord Woolton was quick to disclaim that there was anything "awful" about it. In fact it made a worthy contribution to the successful launching of the campaign.

Luncheon Speeches

Sir DAVID MILNE-WATSON, Bart., LL.D., D.L., who presided, proposed the toast of the National Food Education Campaign, coupled with the name of Lord Woolton, Minister of Food. Among other guests whom they were pleased to welcome, said Sir David, were Mr. A. T. Lennox-Boyd, M.P., Parliamentary Secretary to the Ministry of Food, the Rt. Hon. J. R. Clynes, M.P. (Parliamentary Secretary to the Minister of Food in the last war), and Sir Henry French, K.B.E., C.B. (who was General Secretary of the Food Production Department in the last war).

"I am sure you would wish me to express on your behalf," continued Sir David, "our great pleasure in having with us as our principal guest Lord Woolton, who has recently been appointed Food Controller. This is one of the most important offices in the country at the present time, realizing as we do that it is on the way in which the food supply at home is handled that our success in the war very largely depends. It was Napoleon who said that an army marches on its stomach, and, if that is true for the army, it is equally true of those at home, whether they be munition workers or otherwise. Without adequate food in the country all might be eventually lost. Lord Woolton has recently been giving us very reassuring news about the excellent position which this country occupies on the food front. We are confident in his ability to maintain and to strengthen that position.

"The function at which we welcome Lord Woolton and his colleagues is to mark the inauguration of the Gas Industry's part in the great Food Economy Campaign just launched by his Department. The Gas Industry has eleven million customers, and our Industry depends on women just as much as does the silk trade or the milliner's. There is hardly a woman in England who does not do business with her local gas department. The gas department is one of the hubs of life in every town. Housewives belong to one of the most important professions in this country. There are twelve million of them, all told. The Food Minister has done well to enlist the help of this large body of women. The first thing to do in the line of food defence is to get them to adapt themselves to war-time conditions. The largest item in our expenditure abroad is food. Imported food—20 million tons of it—costs us in a peace-time year £400,000,000. The Government looks to the women of this country to reduce this large sum. By alteration in their catering at home they could cut one half of the foreign purchases off our shopping list and save £200,000,000 a year. But this can be done only by women adopting new ideas as to foods and cooking and adapting themselves to the new conditions. When you consider that every housewife has to prepare 1,000 meals in a year, it is quite plain that each one has a part to play in working for victory.

Keeping the Population Fit

"The part played by housewives is, of course, far wider than simply the avoidance of waste, vitally important though that is. The whole population of the country is in this war, and it is the task of housewives to keep the whole population fit. It is a question of health and morale as well as of anti-waste. There is a great opportunity for improvement in cooking, and we can learn in this matter, as in many others, from our allies, the French. The French say the English have 200 ways of cooking beef, and they are still hoping that we may some day find the right one! Moreover, household peace and harmony between the sexes is much assisted by efficiency on the kitchen front, and housewives will not forget that, though face powder may catch a man, it takes baking powder to hold him.

"There is an enormous amount of waste in this country. Millions of pounds of foodstuffs of various kinds is thrown away or burnt as scrap when it might very well be utilized.

"In all this the Gas Industry can help both the Minister of Food and the housewife. In common with other public utilities in this country we have been doing our utmost in the past ten—some of us even thirty—years to spread up-to-date information on the buying and cooking of food and on all questions of home management. A great new profession has grown up in the Gas Industry—the profession of the trained and qualified domestic science demonstrators who are employed by the various gas departments as home advisers and consultants. The Industry has already assured you, Lord Woolton, that these women can and will extend the work they are already doing to include instruction on war-time buying, catering, cooking, and economy. Although they are paid employees of commercial concerns they are social workers in every sense of the word, for they are trying to raise the national standard of living. They have access to the homes of the people—rich and poor alike. They are in direct contact with the people: that is why this service is aptly called 'Home Service.' If all the women on the books of the Industry which I represent could be reached you would get in contact with 11 million women. No other industry in this country can do this. We welcome co-operation, too, with the Board of Education. This will ensure that the schoolgirl in the domestic science room will be learning the same thing as her mother learns in the demonstration room. We think the domestic science teacher's task is easy compared to the demonstrator's. Growing children are a very ready audience as far as food is concerned. Food is one of their favourite subjects. But the demonstrator has to tackle the experienced housewife who has always done it like that!

"There are in the Gas Industry at the service of its 11 million consumers—who are also your fighters on the Kitchen Front—nearly 1,000 showrooms, some 200 demonstration theatres, and some 400 demonstrators ready to work not merely in those showrooms but everywhere where women can gather together to hear them. Behind this front-line force is the whole power and goodwill of the Gas Industry, ready to support them and to support you."

No Stranger to the Gas Industry

The Rt. Hon. LORD WOOLTON, Minister of Food, replying to Sir David Milne-Watson, thanked him for his good wishes and said he had been glad to have this early opportunity in his career as Minister of Food of meeting the Gas Industry to which he was no stranger in the days when he was a free man, because the advantages of gas cooking were well-known in the enterprise with which he was associated. He was also glad to have had the opportunity of partaking of the excellent meal consisting entirely of unrationed foods. The last thing he would contemplate trying to do would be to teach the Gas Industry anything about advertising, but surely there was a mistake on the leaflet when it said: "How to be Fitter Though Rationed." Should not this be: "How to be Fatter Though Rationed?"

Of course, continued Lord Woolton, we are not really rationed. The number of articles of food and quantities which are available are really quite adequate. He had an easy task in comparison with that of Mr. Clynes in the last war. He was glad to be able to state publicly how grateful he was to Mr. Clynes for the very kindly goodwill which he had received from him as one of his successors in office. (Cheers.)

It was his primary duty to appeal to the housewives of the land. He was anxious to enrol a new army in this country for war service. There were so many people who wanted to help, and

now they were to be given the opportunity. He appealed to those who are running homes to enrol in the emergency corps of the kitchen front. The Gas Industry and its organizations—and that of its little sister industry, electricity—little, of course, when compared in age—had been good enough to produce a very large number of sergeant instructors for this army, and they would teach its troops to "do their stuff."

Many ladies there that day were going to undertake as part of their ordinary work the teaching of women how to cook better—he would not say how to cook, as they *did* know how to cook. It would not do for him to make observations on women's capacity in this direction. He would confine himself to observations on the difficulties that women might have to face in the future, difficulties of supply. This would reflect itself in the kitchen. Yet it was a splendid thing for a new Minister to be presented with 400 trained demonstrators, 200 theatres in which demonstrations could be held, and 1,000 showrooms, fully equipped, all provided free of Government expense. It was an organization which could reach women wherever they were gathered in this country. He was indeed fortunate, and very grateful to the Gas Industry for the magnificent effort it had placed at the disposal of his colleagues of the Ministry of Food. It was not an organization which had suddenly been created for war purposes, and he quite realized that it was instituted on commercial lines, and not altogether without hope of a profit. However, he was not one of those who considered that no enterprise could be good which was connected with the making of a profit, and he was convinced that very great good had already accrued to the public through it.

Advice to Demonstrators

He had one or two things to say to the domestic science demonstrators who were present. The first thing of which he was assured was that they would not have to go and look for clients. If his postbag, following his recent broadcast to the housewives of Great Britain asking them to come and enrol themselves on the kitchen front, was any guidance to willingness, there was a large number of people most anxious to benefit by their tuition. But they must be quick to seize the opportunity. It was no use advertising unless they could at once give the public the goods they advertised. He begged them to keep an eye on the job. They were not really teaching them just how to cook, but how to adapt themselves to meet the emergencies of wartime. Let them use the slogan "Help Your Shipping," though it would not mean much to the ordinary woman without further explanation. She does not know where goods come from, and the demonstrators must tell her which are the foods which we can grow in this country, which are the foods we can buy with sterling exchange, and which are the foods that she should buy if they are in the shops. They did not want goods lying dormant. They must tell her what she should ask for at any particular time according to the available supplies. The demonstrators knew where the foods came from and what was plentiful at any given time, and the public did not.

They were going out on a great national crusade, and it was his business as a member of the Government to say to them that they were really going out on national work. It was their ordinary work—the work for which they had been trained. There were, of course, many people who thought they were performing better national service if they were doing work for which they had not been trained. He, personally, was a magnificent example of that fallacy. (Laughter.) They were in the happy position of going out to do work which they were competent to do. The public attitude of mind was different from that which they would ordinarily find. They were all eager and anxious to know what it was they could do to help their country in the time of national emergency. It was the demonstrators' great privilege to be able to guide them and instruct them.

"On behalf of His Majesty's Government," concluded Lord Woolton, "I am very grateful to you all for the work you are doing and I wish you great joy, and I think you will find great happiness in doing it."

Showing How to Cook

Professor JOHN HILTON, M.A., proposing the toast of the Gas Industry, said: "In these days some of us are working and living away from our homes; and some of us are doing for ourselves. I am one. And as regards cooking, all I will say is: You never know what you can do till you try. And, speaking as a novice, you never know what you have done until it comes out of the pan. I will say this for the Gas Industry: it does not content itself with selling us gas for our cooking, it goes to any amount of trouble and expense to teach us and show us what to cook and how to cook it. And even how to dish it up when it is cooked. To teach us, and to show us! But that needs teachers and showers. They exist; for the Gas Industry has set itself to provide them."

Referring to the demonstrators as "the capable and admirable young ladies who do this job of lighting our culinary darkness," Prof. Hilton said that they knew what to cook and how to cook it. They could transmute a potato into the miner's dream of home, the scrag end of a neck of mutton into a dish for an exiled king. They could make a stew into something that made one determine to lead henceforth a nobler life. They could take you by way of a baked apple, back to the Garden of Eden. They could turn what the mishandlers of words call "offal" into the luscious "fritto misto" over which the company had just been so ardently lingering.

Good Cooks

Miss ETHEL WILLANS, M.B.E., chief woman adviser to the Gas Light and Coke Company, replying to the toast, thanked Prof. Hilton for the generous words of praise he had given to the demonstrators and said that she could endorse every word. Praise was also due to the English housewife who was only too anxious to do her bit to help the nation in its fight for freedom, and who, with the guidance which was forthcoming, would see that there was no wastage and that the food available was used wisely. How could we be a nation of bad cooks, she asked, when in London, in the area of the Gas Light and Coke Company alone, over 50,000 women attend demonstrations in a year? "I maintain," said Miss Willans, "that English women on the whole are good cooks. If only you gentlemen would take notice and praise your wives' culinary efforts and be prepared to try new dishes, then English cooking would reign supreme!

"We have heard of the ultimate fate of the gas demonstrator," concluded Miss Willans, "how gas rings lead to engagement rings. This, gentlemen, shows your good sense, because a perfect demonstrator must be strong, kind, wise, gentle, know when to listen and when to speak, and be a perfect cook—in fact, an angel on earth. But in spite of this fate looming over us, I can assure you, Lord Woolton, that the gas demonstrators in their uniform of cap and overall will march strongly in formation to keep unbroken the kitchen front, and to see that the dustbins are of no interest to even the smallest mouse."

SPECIAL MEETING OF DEMONSTRATORS

After the Luncheon the company adjourned to hear a most interesting and helpful lecture on "Food" by Dr. H. E. Magee, M.B., D.Sc., of the Ministry of Food.

In introducing Dr. Magee, Mr. W. J. Sandeman, J.P., Executive Chairman of the British Commercial Gas Association, said that the Food Campaign was fortunate in that it had the expert backing of eminent men of science and dietitians. He was very glad to see such a large gathering of domestic science demonstrators, representing the Home Service of the Industry, and it was for them to pass on the information and advice which Dr. Magee would give to the housewives of the country. Their presence in such large numbers augured well for the success of the campaign. The Gas Industry had given a great deal of attention to its Home Service, and had to its credit over 400 trained demonstrators, employed in the selection and preparation of foodstuffs. Several circumstances had combined to heighten the importance of their work. How were housewives to take full advantage of the new appliances constantly being put on the market, save by the helpful teaching of trained women who had a complete background of science? The demonstrators were already doing valuable work. Now their scope was to be enlarged through the campaign. The use of home produce should be advocated. Greater care in the elimination of waste in the household should be advised. It would be remembered that only one slice of bread a day wasted would mean that 30 additional shiploads of wheat would have to be imported in the year. The full use should be made of such facts. He was confident that housewives would readily respond. Wastage meant a lot to the country and its elimination was one of the ways in which women could help. He felt sure they would do everything to further the Gas Industry's campaign.

Mr. A. EMIL DAVIES, The Rt. Hon. Chairman of the London County Council, spoke a few words in support of the campaign.

Mrs. EILEEN MURPHY, Director of Home Service of the British Commercial Gas Association, proposed a vote of thanks to Dr. Magee. Women, she said, were beginning to recognize the connexion between good health and good food. They were learning the principles of scientific feeding and she thought the next step would be for doctors to take cookery classes, and they would be judged, not by their bedside manner, but by their knowledge of cookery! The Company was present as helpers in Lord Woolton's campaign and they had a great task before them. They had to go into the homes of Great Britain making an alteration in social habits and giving the housewife new ideas. Women would have to change from peacetime habits to wartime habits. The kitchen would have to take its share in winning victory. Demonstrators would have to show that health depends on the kind of food bought and the cooking of it. The lecture by Dr. Magee would be both useful and practical to them and she felt sure that they would be most grateful for it.

The Design of Solid Hotplates

This article is surely an antidote to depression. It is stimulating; it is encouraging. It indicates possibilities and reveals probabilities. When was it first suggested that the Gas Industry was moribund? We think that many wars have been waged since that idea was mooted. During the present conflict the Industry will give all it is capable of giving; and its unobtrusive research work, exemplified by this article, will be of no small moment in the reconstruction period which lies ahead.

Contributed by
Watson House

THE gas cooker early broke away from the solid fuel range tradition of the solid closed hotplate. The convenience of the solid top, maintained in modern electric and heat-storage, cookers, was exchanged for speed of operation and gas economy. The lower the thermal efficiency the more the waste heat into the kitchen, often to the disadvantage of the cook; hence the practical advantage of the use of the open flame burner. Nowadays, the solid top is virtually to be found on gas hotplates only on heavy duty restaurant cookers having a powerful radiant burner creating a "hot spot" on a large plate on which a number of pots can be heated simultaneously at different temperatures. It is well to remember that the heat transfer per square inch of surface is greater in the case of a pot over a flame than in practically any other gas apparatus, so that improved efficiencies at first sight appeared unlikely. But so important to the Gas Industry is the hotplate that no effort should be spared to effect its further development.

The immediate result of placing a solid cast plate above a normal burner is to slow down the speed of boiling, to increase the amount of gas used, and, often, to create combustion difficulties. It is evident, however, that some users of gas cookers would welcome the convenience and appearance of a solid plate which need not be removed and a systematic survey has been made of the factors which might improve efficiency and so enable such an arrangement to be used. The work is by no means complete, but has progressed far enough to show, by making full use of modern scientific knowledge on heat transfer and burner design, that greater speeds and higher efficiencies on gas hotplates are in fact obtainable if permanent protection from dirt, &c., is provided for the special burner.

A Two-Part Investigation

The work falls into two parts—(1) that concerned with the development of a plate having maximum heat transfer, and (2) that concerned with the development of a suitable burner.

(1) The introduction of a plate between flame and pot introduces three stages in which heat may be lost: (a) between flame and plate, (b) heat capacity of the plate itself—*i.e.*, heat which should be passed into the pot is retained in the plate, (c) between plate and pot.

(a) In order to determine the best form of under-surface to the plate to scrub maximum heat from the flame, pots or kettles were made having bases in the proposed forms, since this cut out the heat losses between plate and base of pot. After a prolonged series of tests fins were discarded in favour of a multiplicity of pips so arranged as to create maximum turbulence in the hot gases passing between them. Expressed in terms of efficiency on a given burner the flat plate showed 29%, the best ribbed plate 48%, and the pipped plate 52%.

These results have been obtained starting with the solid plate cold and removing the kettle at the end of the test—*i.e.*, without using any residual heat left in the hotplate.

The design of studded plate was arrived at after many different designs of plate had been tried, and further systematic investigation will probably lead to still higher thermal efficiencies.

(b) The water equivalent of a 7 in. diameter $\frac{1}{8}$ in. cast iron plate with pips is about 1/7th pint. When heating 3 pints of water it might be expected to represent a 5% decrease in speed and efficiency and a larger handicap for smaller quantities, but tests show that even 1 pint of water can be boiled as efficiently as on an open hotplate. On the other hand, if the solid hotplate is already hot a still higher efficiency is obtained and this is still more efficient than open hotplate tests carried out starting in the hot state. The thickness of the plate represents also some lag to the transference of heat, a result of which is to be anticipated as a tendency to warping of the plate. It is thus desirable to make the plates of minimum thermal capacity, maximum thermal conductivity, and minimum

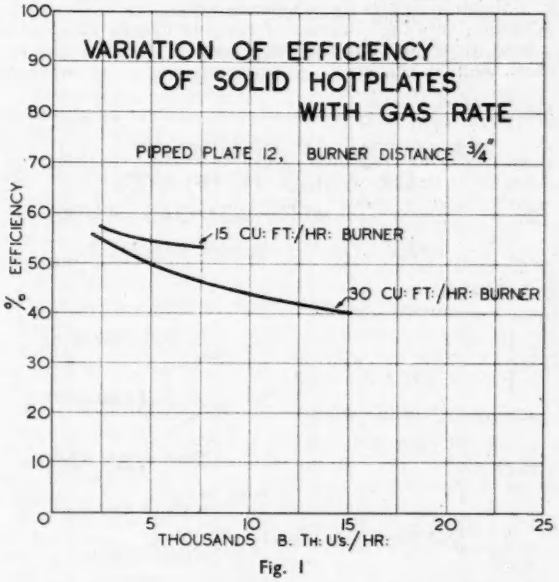


Fig. 1

thickness. Experiments are being made with different materials—*e.g.*, heat-resisting steel and non-ferrous alloys—and with different designs of plate to eliminate warp and corrosion during use. Tests were carried out to determine whether advantage was to be obtained in diminishing radial loss by using, instead of a single plate, a series of concentric rings each lagged edgewise from the other, but the gain appeared negligible.

(c) The main series of tests has been carried out with machined base pots or pots with bases so thin as to make good contact with machined surface plates. In practice plates may warp while pots may be dented. Surface condition for heat transmission by radiation between pot and plate then become important. As between polished and black matt conditions an improvement of 15% may be obtained. Experiments continue with plates dished, serrated, or ribbed on their upper surfaces.

(2) Generally speaking reduction of gas rate is accompanied by increase in efficiency but reduction in speed (Fig. 1). Since speed is so important a factor any sacrifice in efficiency by the introduction of the solid hotplate necessitates increase in gas rate. There is thus a large volume of burning gas to be accommodated in a virtually enclosed space beneath the hotplates. Only when aeration is increased above normal does it appear possible to overcome difficulties of combustion and heat transfer. (Fig. 2.) The practical development of the solid hotplate thus hinges in part upon the design of a new type of burner capable of stable operation at theoretical air gas ratio about 5:1. In this condition enough air for combustion is carried through the burner, the flames are fully aerated and compact, and the space round the burner head is wholly available for exit of the burning gases.

Lighting-Back Difficulties Overcome

If the aeration of the normal bunsen burner is increased it lights back at an air-gas ratio of about 3:1 since the flame velocity exceeds the burner head efflux velocity. With a Meker burner slightly higher air gas ratios are possible. The limit is imposed by the limited energy of the gas at the injector being unable to overcome the head resistance of the burner unless high pressure gas is used. By making use, however, of information now available on flame-proof heads ("GAS JOURNAL," **226,** 935) sheet metal can be perforated with such size and distribution of holes as to make lighting back impossible at any efflux velocity. A burner head made of such metal prevents any lighting back and can be of such size as to give very low head resistance allowing air-gas ratio up to 8:1 to be achieved with low pressure gas. The burner itself can otherwise be of conventional form or may eventually be more conveniently designed on the lines of that shown in Fig. 3, which illustrates the whole assembly.

Although very high degrees of aeration can be obtained it has been found that the maximum aeration does not give the highest thermal efficiency. Experiments are being made to

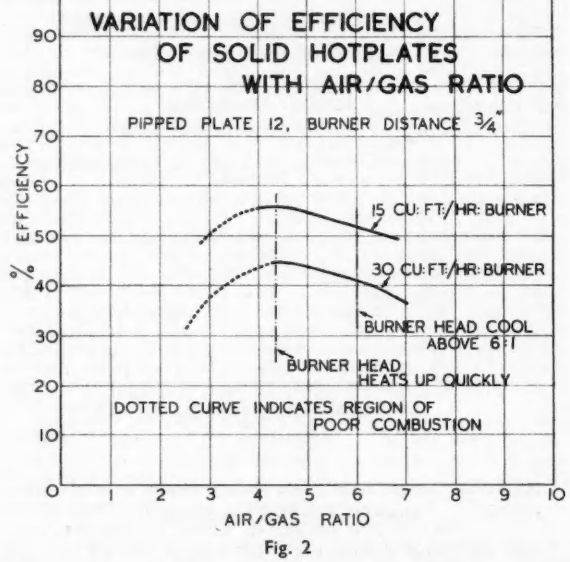


Fig. 2

determine the optimum air gas ratio taking into account the thermal efficiency, combustion efficiency, &c. It has been found that an air-gas ratio of about 7:1 keeps the burner head cool and so reduces considerably the corrosion and distortion of the head in use.

The material of which the burner head is made has also been the subject of some consideration. Perforation with such small holes necessitates a fairly soft material, while conditions of operation demand a rigid non-corrosive metal. Brass can easily be perforated but corrodes too easily, and a high-duty brass such as the proprietary alloy "Tungum" represents a considerable improvement in this respect. It is liable, however, to warp and distort in use, and the search for a better material is still in progress.

Great Increase in Speed

The plate always being in position (except when removed for cleaning) protection is given to the finely perforated burner head the aeration of which would otherwise rapidly be reduced by dirt and spillage. With the arrangement shown, 30 cu.ft. per hour burners can be used as efficiently as the best large open flame burners now in use and consequently with substan-

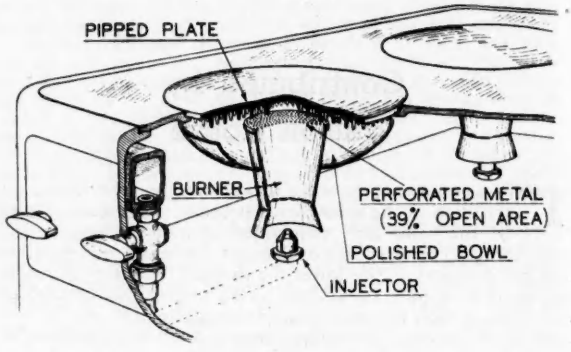


Fig. 3

tial advantage in speed over any domestic boiling burner yet available.

The burner remains perfectly stable when turned down to 1 or 2 cu.ft. per hour and gives admirable simmering or stewing facilities with no local hot spot such as often tends to burning of thick stews, &c., unless stirring is maintained.

Polished bowls beneath the burner have been found to give further increase in efficiency by restricting the flow of excessive cold air around the flame and by reflecting radiant heat thrown downwards by the plate.

When complete hotplates are designed it is expected that the overall practical efficiency will show still greater advances on the open hotplate since hot products of combustion from one burner will flow under the other pipped plates and simmering may be possible without lighting the other burners. Combustion difficulties may still have to be overcome but the completely aerated burner will facilitate the solution of this problem.

The gain in appearance and cleanliness of the solid hotplate needs no emphasis. Before, however, its final forms for production can be determined further work is necessary to determine the most suitable materials and to clear up certain technical points. Above all, with so substantial a departure from conventional design in an appliance of such importance to the Gas Industry, prolonged practical trials are essential before commercial production. Nevertheless it may be of some interest that laboratory experience shows the problem of the gas solid hotplate to be capable of solution without sacrifice of speed or efficiency.

Defence (Gas Charges) Order, 1940

G.C.P.A. Circular to Members

The Gas Companies Protection Association has written calling the attention of all member companies to this Order made by the Board of Trade on March 15, the effect of which is to extend the provisions of the Defence (Gas Charges) Order, 1939, so as to include an increase in the net cost of coal and oil per therm (or per 1,000 cu.ft.) as one of the grounds on which the price of gas may be increased beyond the maximum or the standard price, without affecting dividend authorization except as mentioned in the Order of 1939.

It will be remembered that the effect of the Order of 1939 was fully explained in the Chairman's Address at the Association's Annual General Meeting on Jan. 23. This was reported in full in the "JOURNAL" of Jan. 31, and reprints were sent to all members on Feb. 12.

North British Association of Gas Managers

The Spring Meeting of the North British Association of Gas Managers was held on Friday, April 5, in the Cadoro Restaurant, Glasgow, when there was a large attendance. The President (Mr. H. A. Aitken, Buckhaven and Leven), occupied the chair.

Extending a welcome to those present, the PRESIDENT said that the large muster of members was evidence of the zeal and enthusiasm which animated the personnel of the Gas Industry in Scotland. Unfortunately the circumstances under which they were meeting were less happy than those under which they had gathered together at Leven a year ago. Nevertheless, the conditions were much more favourable that most of them envisaged when their Autumn Meeting at St. Andrews was postponed.

"The intervening months," said Mr. Aitken, "have provided much to perplex those responsible for the control and management of gas undertakings. Added to the necessity, under conditions far from normal, of keeping pace with and giving effect to new rules, regulations, and orders issued with ever-increasing rapidity by various Government Departments, the severe weather conditions experienced in the early months of the year with its accompanying coal supplies, transport, and other difficulties, provided many anxious moments and strenuous times.

"It is no small tribute to those responsible that the exceptional difficulties experienced have been surmounted so successfully and with so little inconvenience to gas consumers. It can be confidently asserted that those who now control the affairs of the Industry will worthily uphold the high tradition of national service established in the last conflict and as expressed by Lord Moulton when in 1917 he paid this tribute: 'Without the direct aid of the Gas Industry and, further than that, the assistance of and the knowledge which has been acquired by those who have devoted their lives to it, it would have been perfectly impossible for this country to have waged the campaigns of the last three years. When I was first asked to take charge of the manufacture and provision of explosives it took me but a few days to realize my absolute dependence upon the Gas Industry.'"

The SECRETARY (Mr. Robert Sturrock) read the minutes of the Annual General Meeting of 1938 and of the Spring Meeting of 1939, and these were approved, on the motion of Mr. GEORGE BRAIDWOOD, seconded by Mr. DAVID FULTON.

Losses by Death

The President said that since last they met they had lost by death various members. These included Mr. James Kincaid (Kirkcaldy), an old chief of his own, who had been associated with their organization since 1889, becoming a member in 1894 and a life member on his retirement in 1938; Mr. James Cochrane (Darvel), a member since 1901; Mr. James D. Whitelaw, of Alexander Cameron's, an extraordinary member since 1909; and Mr. James F. Cameron, of Walker & Cameron, who became an extraordinary member in 1922. The death had also occurred since their last meeting of Mr. Peter Blackhall, of Alder & Mackay, who, though not a member, had taken a keen interest in the Association, particularly in its social activities. Members were upstanding in token of respect.

The SECRETARY intimated apologies for absence from officers of various kindred associations and from members. The President thereafter introduced Mr. George Dixon, President of The Institution of Gas Engineers.

Mr. DIXON said the President of the Institution required a holiday and could think of no better way of spending it than coming to Scotland. Their London friends wished to congratulate the members of the North British Association on their determination to carry on. The splendid attendance that day augured well for the Industry and showed their desire to keep informed of the technical movements in their profession.

Annual Report

The PRESIDENT said they all regretted the necessity for cancelling the arrangements made last autumn to meet at St. Andrews, where the Town Council and the Chairman, Directors, and Manager of the local Gas Company had made great preparations for their comfort and enjoyment. Mr. Cantley, the Town Clerk, who was also Chairman of the Gas Company, had written to express the hope that in happier times they might still visit St. Andrews. The arrangements for celebrating the William Murdoch Centenary in November last had also to be cancelled. The rules and regulations of the Association made no provision for the present circumstances and the Council had acted as seemed best in its interests. He did not doubt that the members would approve of what had been done. The Report and Financial Statement had been placed in their hands and fell now to be approved. They would be gratified to see that the Paper read by Mr. J. E. Blundell (Carlisle) at their Largs meeting had obtained the Silver Medal of the Institution as the best Paper delivered to an affiliated Association in 1938. He wished also to express his thanks to Mr. Archibald Kellock for his valuable services as Secretary and Treasurer of the Association and to intimate that Mr. Robert Sturrock, of Ardrossan, had been appointed by the Council to succeed him.

New Members

The SECRETARY announced that the following had been admitted as members of the Association:

Ordinary Members.—John G. Aitken, Gas Manager, Carlisle; George T. Duncan, Gas Manager, Doune; Archibald McLean, Gas Manager, Dunblane; Sydney Smith, Gas Manager, Paisley.

Transferred from Associate Membership.—Robert Cowie, Jnr., Joint Gas Manager, Hawick.

Extraordinary Members.—James A. Baker, Sales Manager for Scotland, Messrs. Maxol Heaters, Ltd., Manchester; John L. Butler, Managing Director, Messrs. W. J. Jenkins & Co., Ltd., Retford, Notts; Robert Gillespie, Director, Messrs. Scottish Enamelling Co., Ltd., Larbert; Robert C. Matthews, Resident Engineer for Scotland, Messrs. George Waller & Son, Ltd., Stroud; John Pollock, Sales Manager, Messrs. Alex. Russell & Co. (Glasgow), Ltd., Glasgow; Edward C. Thomson, Manager, Messrs. James Dougall & Sons, Ltd., Bonnybridge.

Life Members.—James E. Blundell, 69, Queen's Road, Southport; S. Milne, 5, Bayview Road, Aberdeen.

On the motion of Mr. A. KELLOCK, seconded by Mr. T. S. LOCKHART, it was agreed to approve of the Council's recommendation to elect the officers at the autumn meeting.

"EFFECTS OF STORAGE ON COAL"

Mr. D. D. MELVIN (Edinburgh) then read his Paper on "Remarks on the Effect of Storage on Coal." This was published in last week's "JOURNAL," and the following is the discussion which took place on the Paper.

The **President** said that Mr. Melvin had prepared his Paper at short notice. It was a useful and valuable address and should form a basis for a good discussion.

Mr. **A. Jamieson** (Johnstone) said he had some experience in using stored coal in the last two months. It was unfortunate that the Edinburgh tests dealt only with coal and not with washed fuel. It had been the practice in Johnstone for some years to divide the coal into separate bins. It was changed over every four years. They found that coal in stock for twelve months was not much better than coal stored for four years. At one time they had taken into stock 200 tons of triping, 70% being fines and 30% lump coal. After being laid up for three or four years it had proved of exceptional quality and gave no trouble. It had proved an ideal fuel. He would like Mr. Melvin to give some information on any tests carried out with washed fuel.

Mr. **T. S. Lockhart** (Rothesay) asked if in any of the tests they had tried covering their coal with dross. In Rothesay they had laid in 300 tons of trebles and had covered them with a 6-in. layer of dross. He had been compelled to broach this stock recently and there appeared to be no deterioration in the coal. The results were good and the coke was excellent.

Mr. **W. Kirk** (Motherwell) said that Mr. Melvin's Paper was most opportune. Most of them had within recent months the unhappy experience of having to carbonize weathered coals. They were, therefore, in a position more readily to appreciate the facts

and figures put before them. It was remarkable that such a great Industry as theirs, depending so much on black diamonds—apparently going to cost as much in the near future as real diamonds—should know so little about coal. The Paper they had heard was a useful addition to their meagre knowledge of the subject. The storage question was much to the fore in view of the suggestion that they should lay down stocks this summer. The loss of caking power by storage had been amply demonstrated in recent times, and he could substantiate Mr. Melvin's remarks regarding disorganization within the retort house. The further the coal stock was eaten into the greater was the amount of breeze produced, with a corresponding adverse effect on heat and results generally. That was his experience and it became necessary to grape all coke going to the producers. Ultimately he was compelled to use fresh coal for four retorts and reserve the coke for the producers only. In view of his recent experience he wondered if Mr. Melvin's researches had led him to form any opinion on the size of coal most suitable for storing or was the size of no importance? It was well known that clarain and vitrain were the coke-forming constituents in coal and he wondered if it was possible to produce synthetically a product having these characteristics. The stock coal could then have an admixture in the bunkers prior to carbonizing. The successful production of such a substance would open up new fields of carbonization in low-caking power coals and might lead to smokeless fuel production.

A Topical Subject

Mr. **Sydney Smith** (Paisley) complimented Mr. Melvin on bringing before them such a topical subject. The recommendation to stock coals of high-caking quality was aptly qualified by the words "when and where possible." He would be a fortunate man who would be able to pick and choose under existing conditions. The question of accepting deliveries in equal monthly quantities would commend itself to those Engineers who were blessed with handling plant which allowed them to put into and take out of stock at reasonable cost. It would be interesting if Mr. Melvin could tell them if any undertaking had been successful in inducing coal suppliers to agree to a reduction in cost commensurate with the increased handling charges, making due allowance for the advantages gained in carbonizing coals not affected by depreciation in storage. If ten to twelve weeks' stock at maximum consumption was to be taken as a necessity in the future—and at least an annual turnover of stock would appear to be the object at which to aim—the cost involved to many of them would be considerable and, in the case of Paisley, would amount to a fairly substantial increase in the price of gas. In keeping with many other works, the Paisley stock had been stagnant following the 1926 strike and for this reason Mr. Melvin's figures were all the more interesting. They had had no opportunity of carrying out tests on similar lines, but the working results during a period in January, when they were wholly on stock coal, showed a considerable reduction on the figures mentioned. The Paisley therm yield dropped by almost 20% when maintaining the declared calorific value, and the coke yield, as coke, disappeared completely, the discharges consisting wholly of material below 1¼ in., with fully 50% below ¾ in. There was no need to enlarge on the vicious circle caused by this fuel being fed to producers. The investigations carried out in Edinburgh made it obvious that, when and where practicable, steps should be taken to instal handling plant which would enable them to turn over their stocks within a period which would eliminate as far as possible, the losses attendant on prolonged storage.

Mr. **J. M. Dow** (Kirkcaldy) said they were wondering where they could get caking coal. He was assuming that the storage tests in Edinburgh were carried out in the open. What was the effect on coal stored under cover and in darkness? At Kirkcaldy they stored their coal under cover and away from the light, and while they had deterioration it was not so much as that indicated by Mr. Melvin.

Colossal Burden

Mr. **R. D. Keillor** (Greenock) said the question of laying down ten to twelve weeks' maximum requirements of coal would saddle undertakings with an extra expense of from 1s. to 1s. 6d. per ton carbonized during the year. There was the loss of interest on the money so expended, and there was the cost of mechanical handling. If handbarrows were used he estimated the extra cost would work out at 2s. 6d. per ton. If prices were to be increased in the next contractual period the burden would be colossal. It would ultimately fall on the consumer and would work out at an extra ½d. per therm.

Mr. **A. C. Rea** (Perth) said the deterioration of coals stocked under cover was slight compared with new coals stocked out-of-doors. If they were to stock ten weeks' supply it meant having coals in depth, with the risk of spontaneous combustion. One of the conditions of his insurance was that the temperature of stocked coals had to be taken twice weekly. Most of them were using washed fuel, and many of them were able to store under cover, so that the figures of loss given by Mr. Melvin could be considerably reduced. He would like more precise information regarding the assessing of results by the Woodall-Duckham button test, while he would also welcome information as to benzole extraction results. The figure of 250,000 tons was given as the coal stock in Scottish undertakings. That was equal to five weeks' maximum supply. They were to carry ten weeks' supply so that the increased costs would not be so great as Mr. Keillor suggested. He agreed with Mr. Melvin that caking coals should be stocked and that they should stock doubles in preference to singles.

Mr. **R. Fife** (Kilmarnock) said the Edinburgh tests had opened up a wide field of investigation. In Kilmarnock they stored both out of doors and under cover and found that storing under cover prevented depreciation. The action of sun and air on coal had the effect of disintegrating it. They had found the amount of gas per ton was slightly higher from coal six years in stock, but the calorific value was lower and the therms per ton not so many at the end of the day. He would also like information as to the difference between coal stocked in the open and that kept under cover and also some details about spontaneous combustion.

Mr. **Melvin,** replying to the discussion, said it was only since 1933 that the Edinburgh Gas Department had been associated with the Fuel Research Board in a series of tests. Their coals were stored in the open. Coals so stored were certainly more pleasant to handle. They had used some washed fuel in their tests, but they were caking smalls and pearls. The suggestion that coal might have to be taken in by monthly deliveries was not his suggestion, but if they had to accept it they would require compensation in some form for having to take it in this way. They did not cover their coal with dross in Edinburgh, but this might prevent infiltration of air. Coals stored under water appeared to keep better. With regard to the button test, if they did not get a button in twelve months they would know that the coal had depreciated so much that they would not be able to use it!

"GAS-MAKING UNITS AT ROTHESAY"

Mr. T. S. Lockhart, Rothesay, thereafter read his Paper on "Gas-Making Units in Rothesay." This also was published last week, and below is a report of the discussion which followed.

Mr. **Sydney Smith** (Paisley) asked if there were any figures available of the cost of manufacturing carburetted water gas compared with coal gas and, if so, on what basis was the coke price taken?

Mr. **R. D. Keillor** (Greenock) said the capacity of the Rothesay plant was stated to be 560,000 cu.ft. daily. When considering the gas-make value of a plant they were accustomed to allow for a 5% or 6% loss per annum for each unit of the retort plant. The generator was emptied one day per week, and they presumed it was making no gas that day, which meant a loss of 14%. They were inclined to over-estimate the value of carburetted water gas plant. They had a day's loss with it for scurfing or de-clinkering.

Mr. **A. Jamieson** (Johnstone) said that in Rothesay, according to Mr. Lockhart's figures, they produced 97.49 therms per ton and also got 6.04 cwt. of coke per ton of coal. In Johnstone the figures were 88 therms and only 5¼ cwt. of coke. He would like more information on this point.

Mr. **A. C. Rea** (Perth) asked if Mr. Lockhart left his coke out in the yard exposed to rain.

Mr. **R. Fife** (Kilmarnock) said that in the days when they used carburetted water gas in Kilmarnock they had trouble with the purifiers. Had Mr. Lockhart anything to say on this subject?

Mr. **Lockhart** said that Mr. Keillor was correct in the point he had raised. On days when the generator was being emptied and de-clinkered only a period of three or four hours was lost if they needed the plant. Prior to the introduction of carburetted water gas the coke yield was from 8.7 to 9 cwt. Anything up to 800 tons of coke lay in the yard for months. In reply to Mr. Rea, he covered the coke with tarpaulin to keep it in as good condition as possible. He wanted to be well insured against trouble. In practice the coke accumulated a quantity of water lying in the open. They had no great trouble with purifiers.

Votes of Thanks

Mr. **Archibald Kellock** (Airdrie), Senior Vice-President, said the President had a very difficult task under present conditions. They had some trepidation regarding holding the meeting and getting suitable Papers, but their expectations had been surpassed. The Papers had provoked good discussions and would be very helpful to them all. The traditions of their Association had been well maintained and he was glad to see younger members taking part in the discussion. He proposed a hearty vote of thanks to Mr. Melvin and Mr. Lockhart.

Mr. **James Dickson** (Kirkintilloch) proposed a vote of thanks to the President. The fact that he had agreed to keep the chair for another year put them all in his debt, and the outstanding attendance that day showed they appreciated his work.

Mr. **Aitken** responded briefly, thanking the members and Council for their support and co-operation.

[*A report of the speeches at the Association's luncheon will be given in a subsequent issue of the* "JOURNAL."]

Experiences in Laying the West Yorkshire Gas Grid

by

L. W. ROBERTS, Assoc.M.Inst.C.E.,

Resident Engineer, West Yorkshire Gas Distribution Company.

From a Paper to the Yorkshire Junior Gas Association at Leeds on March 30

The West Yorkshire Gas Grid was constructed to supply coke oven gas to various gas undertakings in the West Riding. The scheme for the development and construction was evolved by Colonel W. M. Carr, Managing Director of the United Kingdom Gas Corporation, Ltd., and the whole of the plans, specifications, and organization of the work was carried out under his direction by the Technical Staff at the Central Administration Offices of the Corporation in Manchester.

The Author commenced his duties with the West Yorkshire Gas Distribution Company after the first of the contracts for the mainlaying had been let. He is indebted to Mr. H. B. Taylor, the Engineer responsible for the control of the work, for making available to him the following general information.

The initial scheme, comprising 60 miles of trunk mains roughly takes the form of a letter Y. The trunk main commences at Hemsworth and passes through Featherstone, Castleford, Rothwell, East Ardsley, Morley, and Drighlington to Pudsey. Immediately North of Castleford a branch follows the Roman Ridge to Aberford, and then along the North Road to Wetherby. At this point, a connexion is made to the high pressure system of the Harrogate Gas Company. There are branches to Normanton, Knottingley, South Milford and Kippax.

Coke ovens are situated at Hemsworth, Glasshoughton, Whitwood, and Robin Hood.

Strip Plans

The route of the various sections of main which had been agreed with the local authorities was drawn on 25 in. Ordnance sheets. The sheet was then cut down to a strip 6½ in. wide. The strips for a whole section were then reproduced as radiographs twice the size—*i.e.*, to a scale of 50 in. to 1 mile from which any number of prints could be taken. Prints for each section were joined into a continuous strip and folded to 13 in. by 11 in. with the two end folds mounted on stiff cards forming serviceable covers or backs. The surveyed route of the main showing bends, junctions, tees, hatch boxes was then plotted with copious notes for the guidance of the Resident Engineer. The roads were colour washed in different shades to indicate the different Administrative Authorities. Where wayleaves through private property had been negotiated, brief but essential information was given regarding the tenants, owners, and special precautions to be taken during the progress of the work. Standard notes common to each section were printed on the front cover. These maps provided the working drawings to which the main was laid.

Materials

The Grid was designed and constructed to carry gas at a pressure of 30 lb. per sq.in. Spun iron pipes with Stanton-Wilson joints were used throughout with the exception of special crossings and the Knottingley Branch, where steel tubes with sleeve welded joints were used.

The syphons used were specially designed for this scheme and are self-acting. They are of circular section with a spherical base. The lid may be described as a spherical blank flange. The fittings comprise ¼ in. diameter stainless steel tubes and a cast-iron three-way cock. One tube passes through the lid almost to the bottom of the syphon pot forming the dip pipe. The other tube passes just through the lid and is used for pressure readings. The third tube rising upwards from the cock is the outlet, covered with a galvanized iron cap. To clear the syphon of condensate, a short length of hose having a half union on one end is screwed to the top of the outlet pipe. The cock is turned to connect the dip pipe to the outlet and the gas pressure acting on the surface of the condensate forces it through the dip pipe and hose. If pressure readings are required, a gauge with a standpipe is similarly fixed to the outlet pipe and the cock is turned to connect the pressure tube to the gauge.

From each coke oven plant, hatch boxes with large cleaning covers were placed at intervals of 200 yd. over a length of 2,000 yd. The intermediate bends also had cleaning covers. A wire drag-rope was left in the main, and at each hatch box and syphon it was cut and had shackles and thimbles fitted. At each hatch box there is a ¼ in. standpipe and valve where pressure readings can be taken to locate any obstruction to the flow of gas. If an obstruction does occur the adjacent hatch box covers can be removed, the rope unshackled and used to draw cleaning tools through the main. During this operation the drag-rope will have a pilot wire attached so that it can be replaced when the obstruction has been removed.

The valves are placed at points one mile apart. They are parallel faced valves with inside screw, having stainless steel spindles and faces.

Testing and Delivery of Materials

All the materials used were subjected to mechanical and physical tests before being delivered to site. Pipes and special castings were manufactured to the British Standard Specification for pipes class "B." They were hydraulically tested to 400 ft. head of water and 60 lb. air pressure. Ring tests were also carried out and test bars were taken. All valves, including main stop valves and small auxiliary valves were tested to 60 lb. air pressure and 200 lb. water pressure maintained for 15 minutes.

Towards the end of 1938 most of the materials required had been ordered and the contracts had been let to four contractors for the initial 52½ miles of the scheme. Work commenced on Jan. 16, 1939.

The contractors had undertaken to lay specified lengths of main each week. These lengths varied from 230 to 1,000 yds. per week. Approximately 10,000 tons of castings were required. There were 23 squads of men working over a road system approximately 50 miles. The first problem was therefore how to maintain supplies of pipes and special castings at a steady rate to keep every gang busy, and not to have too much material lying about for long periods.

From the length of main required to be laid per week, the number of pipes required per day was ascertained. The London, Midland, and Scottish and London and North Eastern Railway Companies were approached and informed of the quantities of pipes required per day at different places in their delivery areas. They drew up a list of the most convenient stations to which pipes were to be despatched to ensure easy delivery to site. A fleet of 17 of the Railway Companies' road vehicles was reserved specially to transport the pipes and castings from the stations to the various sites where work was in progress. Materials were only delivered by those vehicles to site on or adjacent to hard roads. Where the route of main was in agricultural land, the materials were handled by the contractors who used specially constructed bogies and sledges drawn by horses.

A few loads of pipes were delivered by road, but railway transport proved to be more convenient and flexible.

By adopting rail transport a steady flow of materials was maintained on rail. The Goods Stations became warehouses where small stocks could be accumulated, and the rate of flow from the stations could be regulated daily to suit the require-

ments at site. Another great convenience was the ease with which the Railway Company's low road vehicles could be unloaded.

Road transport from the foundry proved very inconvenient. To make a paying load, the vehicles have to be loaded high with pipes and it is not easy to unload 18 in., 15 in., 12 in. or 10 in. diameter C.I. pipes from high levels on to hard roads without lifting tackle.

The drivers of the vehicles were strangers to the district and they lost time in finding their destinations. The times of their arrival could not be fixed and it was often inconvenient to detach a number of men to unload.

Where the route of the main was on the railway side, pipes were delivered on Sundays by slow moving goods train. Traffic arrangements were made with the Railway Company three weeks beforehand and the train made up of 12 or more wagons arrived early in the morning. It stopped at the beginning of the section and enough men were available to drop one pipe from each wagon simultaneously. An extra pipe was dropped here and there to make up for spaces between wagons. The train moved on, stopped again and the process was repeated. By this means ninety 18 in. dia. 18 ft. pipes were unloaded in five hours.

Supervision

Twelve Supervisors were appointed to look after the interests of the Distribution Company. They were men with general mainlaying and contractors' experience. They understood clearly the work to be done and were qualified to see that the workmanship was up to the required standard. Their duties also included the keeping of daily records.

Stanton-Wilson joints were generally used and it was essential that the supervisors thoroughly understood how the joint should be made. A demonstration by the makers' technical experts was therefore arranged. An 18 in. dia. pipe was fixed on a low bench. Another 18 in. dia. pipe was set on rollers so that the spigot end could be easily pushed into the socket of the fixed pipe.

The men worked in pairs and made and unmade the joint until they became expert.

The length under test, number of joints, the method, pressure readings, period of test—all this information was recorded daily on a weekly sheet which was returned to the Resident Engineer's office every Thursday morning. In addition to this record there were two more reports. A third party report recorded alterations or damage to third party's property —*e.g.*, drains, sewers, cables, water pipes, gas pipes, or other works.

The third report was a special crossing sheet giving daywork details, a description of work carried out, and bill of cost. Special crossings comprised work other than straight mainlaying. Bridge and railway crossings, excavation under culverts and headings were specified items charged at daywork rates.

From the details given on these reports, it was a simple matter to check contractors' accounts, and disputes were entirely eliminated.

Progress

Mainlaying charts were plotted for each section every week showing the lengths of main laid, tested, and the lengths of trench temporarily reinstated. From these charts it was possible to see at a glance the exact position of any section, whether the work was being carried out at schedule rate, the date of completion if the present rate was maintained, and the position of temporary reinstatement behind the mainlayers.

Testing was carried out with air at 60 lb. per sq.in. Stanton-Wilson joints were tested with Felton testers. These testers take the form of a flexible rubber bag which is clamped round the joint and filled with water. It is so formed that the whole joint is covered with water and the smallest leaks are easily spotted. Flange and welded joints were tested with soap solution.

Sections of main were tested in convenient lengths, approximately 200-400 yd. The leading end was capped or plugged and secured with struts and jacks, according to the nature of the ground.

The pressure was raised to 60 lb. per sq.in. and had to remain steady for 12 hours. During this period all the joints were tested in the manner described. If the pressure failed to remain steady and the joints proved tight, a split spigot or split body was indicated. A split in the body of a pipe is more difficult to locate. Two methods were used to find split pipes. A stethoscope with a specially constructed microphone, connected to a two valve amplifier and head-phones, was used with indifferent success. The microphone is moved over the track of the main and the leak can be detected by the peculiar noise that is heard and which increases in volume as the source of the leak is approached.

This apparatus is best used on a quiet night when there is little or no traffic moving about. It is also essential that the operator has considerable experience with the apparatus so that he can distinguish the noise made by the leak from other extraneous noises.

Another method was to inject a small quantity of ethyl mercaptan into the main at the end where the pressure was raised. The leak was easily detected by the strong pungent odour of the ethyl mercaptan escaping from the faulty pipes.

Before the pressure is raised a number of holes should be driven into the ground over the main with a bar, down to the level of the pipe. This gives easy access to the surface for the strong smelling ethyl mercaptan.

Plotting the Exact Route

The route of the main shown on strip maps previously described was subject to deviation due to unforseen obstructions revealed by trial holes. A chain survey of each section was made as mainlaying progressed and details were recorded of the cover, nature of subsoil, unforseen obstructions, and crossing of other public utility services; the exact position of valves, syphons, and hatch boxes. These details have been recorded on a further set of strip maps, with large scale drawings at points of special complexity, thus providing a complete and accurate record of the main as laid. The record is available for the help of Road Authorities and other Undertakings.

During the extensive excavations that were made, many other public utility services were exposed, and the supervisors had instructions to see that these other services suffered no damage. Where damage did occur the matter was reported to the owner and a record sent to the Resident Engineer giving full details. Power cables and Post Office telephone lines are most vulnerable and require specialists to carry out repairs.

Early in the progress of the work, the Yorkshire Electric Power Company and the Post Office Telephone Department were given the opportunity to examine the strip plans giving details of the route, and were also supplied with the route map to a scale of 1 in. to 1 mile. The Yorkshire Electric Power Company marked on the route map the approximate position of their cables, both high and low tension. The Post Office supplied a set of Ordnance sheet prints showing the position of underground telephone lines. It was thus possible to warn the supervisors where to expect cables. In addition, a weekly schedule was sent to the two interested parties. This schedule gave the position of each gang on the Thursday of each week. Both the Yorkshire Electric Power Company and Post Office could then inform their inspectors when and where to keep watch and see that their respective underground works were not disturbed. They could also make examinations and tests before the excavations were back filled.

The importance of this opportunity cannot be exaggerated, particularly in respect of power cables. The point of a pick or a pinch bar may strike the protective covering of the cable. In so doing, the bitumen outer cover is damaged, the steel armouring may be pierced, or perhaps only two strands of the armouring are temporarily separated. In either case the lead sheathing underneath the armouring is bruised and cracked just sufficient to allow moisture to pass through and be absorbed by the paper insulation on the cable. If the striking of the cable is not reported, or passes unnoticed, the punctured waterproof covering is not repaired. The trench is backfilled, and the moisture of the earth gradually permeates the insulation until breakdown in the service occurs. Such a breakdown may occur as long as three months or more afterwards. The inconvenience and trouble caused to the owners is extremely annoying, and in

the case of a high-tension cable, the cost of the repairs may run into hundreds of pounds.

After all sections of main had passed the final test, the whole system was purged with town gas. A small high-speed booster was installed at Castleford having a rated output of 40,000 cu.ft. per hour. Standpipes 3 in. in diameter were erected at the terminal points, and town gas was boosted into the main at a rate of approximately 10,000 cu.ft. per hour.

The total free capacity of the initial 52½ miles of the system is 272,000 cu.ft. The volume of gas required to purge the system was 547,000 cu.ft. Some interesting details are given below:

5 miles 18 in. dia. main having a capacity of 55,600 cu.ft. required 105,000 cu.ft. gas.

2·8 miles 12 in. main having a capacity of 12,800 cu.ft. required 26,000 cu.ft. gas.

5·7 miles 4 in. main having a capacity 2,845 cu.ft. required 3,500 cu.ft.

As purging proceeded samples were drawn from the standpipe and tested for oxygen. One length of main comprising 1.6 miles of 18 in., 5.9 miles of 15 in., and 9.3 miles of 12 in.—that is, a total of 16.8 miles—with a capacity of 98,300 cu.ft. was purged in 24 hours. The initial pressure was 10½ in. water gauge. At a distance of 7½ miles from the booster the pressure was 8½ in., and at the terminal point 16.8 miles from the booster the pressure was 6½ in. water gauge.

Interesting Records

During the progress of mainlaying, some interesting records were made at the request of the Institution of Civil Engineers. These may be summarized as follows:

1. The size or sizes of pipe laid.
2. The method of casting and analysis.
3. The name or names of the makers.
4. The map of the system showing date of burial of the various sections.
5. Details of the methods adopted for protecting the inside and the outside of the pipes. Any specifications or analyses of the protective materials.
6. The methods used for protecting the joints.
7. Particulars of the various types of soil in which the pipes are laid, including any soil analyses that may be made.
8. Any variations in the external protection made to suit the soil.
9. Depth of burial and of the method of refilling the trenches. Is the depth varied with the type of soil, or only as the traffic and other conditions may require?

The whole of the information collected under these headings is sufficient material for another Paper. The Author proposes therefore to present the details of item No. 7 only, which is subdivided into four parts:

(a) Chemical analyses of soils.
(b) Analyses of water soluble extract.
(c) Electrical resistivity.
(d) Accelerated corrosion test.

Referring to the results of (b), (c), and (d), these are of particular interest. Similar tests are being made from time to time on soils from different localities with a view to correlating all the results and forming from them the relationship of electrical resistivity to soil corrosion.

At the present time no definite ruling can be given, but if a relationship can be established it is a simple matter to make tests for electrical resistivity along the proposed route of a new main. Should these tests indicate soil with corrosive properties, samples of the soil would show by analysis of the water soluble extract the aggressive agent and suitable protective coatings could be applied to the pipes before being despatched from the manufacturers.

Samples of Soil

Ten samples of soil were taken from points between Featherstone and Bramham Cross Roads on the Great North Road. An average sample from a depth of 4 ft. was taken from each point in order to give results on the soil around the pipe.

The appearance of samples was as follows:

1a. Black ash and clinker with small amount of stone and clay, depth 6 ft.
1b. Dark brown clay. Below sample 1a, fairly "fat."
2. Light brown gritty clay.
3. Light brown gritty clay. "Fatter" than sample 2.
4. Light grey rock.
5. Dark brown "fat" clay with gritty feel.
6. Light brown "fat" clay with gritty feel.
7. Very old ashes and clinker—easily crushed.
8. Dark buff "fat" clay.
9. Warm brown "fat" clay.

The results of the tests are given in the tables and may be summarized as follows:

The resistivity is very low in Nos. 1a and 7. This is caused by the conductivity of the free carbon in these soils and also by the presence of other pipe lines in the vicinity.

The results obtained on Nos. 3, 4, 5, 8, and 9 show these soils to be fairly constant in their characteristics to a total depth of 8 ft., while Nos. 2 and 6 become progressively better as the depth increases from 2 ft. to 8 ft.

1a appears to have the most corrosive tendencies.

A similar type of soil (No. 7) seems to have had the majority of aggressive salts washed out in the many years of its existence.

A high resistivity and low nipple and can test result on samples 2, 4, 6, and 9 suggest that there should be no trouble due to corrosion of pipes in these areas.

The clay below 6 ft. of 1b. has corrosive tendencies, probably due to aggressive salt washed down from the clinker and ashes covering it, while soil at points 3, 5, and 8 should also be viewed with suspicion.

DISCUSSION

The **President** (Mr. T. G. Lewis, Leeds), after complimenting Mr. Roberts on a most informative Paper, said the engineers in charge of the scheme had shown great forethought in preparing the work, in arranging with local authorities, and in planning transport of the materials over considerable distances. The gas grid covered an area of approximately 700 square miles, and it was aimed by this scheme of "pit to consumer" service to afford cheap gas to many thousands of consumers. It was a great experiment which all in the Industry would watch through the coming years with much interest. Mr. Lewis recalled that at the annual meeting of the South Yorkshire Gas Grid Company two statements were made which were of special interest to-day. The Manager of the Company had been able to record remarkable

WATER SOLUBLE EXTRACT.

100 grammes of each soil was shaken up in 1 litre of cold distilled water and an analysis was made on the clear solution.

All results expressed as a percentage of the dried clay.

	1a.	1b.	2.	3.	4.	5.	6.	7.	8.	9.
Lime (CaO)	0.223	0.018	0.043	0.033	0.043	0.083	0.050	0.100	0.008	0.100
Magnesia (MgO) ...	0.008	0.019	0.014	0.017	0.010	0.005	0.010	0.002	0.028	0.007
Sulphates as (SO3) ...	0.330	0.041	0.003	0.017	0.031	0.113	0.031	0.009	0.020	0.034
	0.561	0.078	0.060	0.067	0.084	0.201	0.091	0.171	0.056	0.141
No chlorides present in any of the samples.										
P.H. Value ... ... (Distilled water = 6.0)	7.5	7.5	7.4	7.3	7.6	7.4	7.4	7.2	7.6	6.0

ELECTRICAL RESISTIVITY—*Specific Resistance: ohms per cubic centimetre.*

Total Depth.									
2 feet	—	Not	18,840	4,335	11,310	4,147	18,850	565	3,016	7,917
4 ,, ...	1,695	Tested.	26,390	4,895	15,080	4,522	25,128	188	3,016	6,786
8 ,, ...	854	19.5	37,680	5,576	11,322	5,271	30,144	1,507	3,165	7,535
% WATER	9.0	19.5	14.6	13.3	9.3	18.6	18.7	15.3	22.2	19.0

The water content of the soil is given at this point as it can affect resistivity.

ACCELERATED CORROSION TEST (*Nipple and Can*).

ACCELERATED.—This test consists of applying a direct current at a potential of 6 volts for 24 hours to a mild steel test piece which is packed in the soil under test. The test piece is made positive, the soil container negative, and the soil has water added to visible saturation.

Loss in weight	2.92	1.81	0.60	1.97	1.40	1.12	0.70	0.69	1.70	1.02

increases in consumption during the eight or nine years during which the scheme was being brought to completion. The Chairman had remarked that the great demand for industrial purposes had made it necessary to manufacture larger quantities of gas at the works to supplement the supply of coke oven gas, but the cost of that gas had considerably exceeded that of the coke oven gas. "I do not desire to comment on these statements (said Mr. Lewis), but give them to show that in the adoption of coke oven gas for town supply there is a definite future, if similar results can be shown."

Mr. **C. S. Shapley** (Engineer and Manager, Leeds) welcomed the Association on another visit to Leeds and congratulated Mr. Roberts on an excellent Paper. The grid scheme and its future, he said, would be watched with keen interest by all in the Industry. Personally, he had never been much enamoured of the use of coke oven gas for town purposes, and he must confess he had never seen the virtues of coke oven gas in the direction of making a coke market and saving transport, &c. The coke market had already been made in the various towns, and he had not as yet been able to see where the domestic consumer benefited from the use of coke oven gas as against town gas made at the gas-works. He could see, perhaps, some possibilities for it in the matter of industrial gas consumers, but it was important to remember that the domestic consumer was the Gas Industry's mainstay, and he did not feel the domestic consumer should be called on to subsidize or pay in any way for the benefit of the large industrial user. Mr. Shapley said he was not quite clear why the newly-laid mains were tested after filling in the trench. Usual practice, he supposed—certainly in Leeds—was to test a new main before filling in. Mr. Shapley asked, also, for a little more detail as to the purpose of the hatch boxes mentioned in the Paper. Some time or other the main would have to be cleaned out, and what was to happen while that cleaning was going on? He presumed the gas was put in naphthalene free, and it would be interesting to know just what the hatch boxes were for.

A Final Test

Mr. **Roberts** said the test of the mains after filling in was the final test. The main had also been tested while being laid, but a final test was made over the whole of each section on completion. The hatch boxes were to provide access to the main in case there was a stoppage at any future date. The whole of the gas delivered through the grid was supplied into existing gasholders at the several undertakings in the system, and he did not suppose any great hardship would be experienced in the event of a trunk mains stoppage for twelve or even up to sixteen hours, as the undertakings all had their local storage.

Mr. **J. W. Carlton** (Shipley) asked if any difficulty had been experienced in regard to corrosion of the steel mains, and if there had been condensate present in view of the high pressure conditions under which they worked. Mr. Carlton also enquired the reason for the use of two different types of joint in the course of the system.

Mr. **Roberts** said the scheme was only completed last October, and therefore nothing was known of corrosion yet. Up to date there had been no condensate further than two miles from the coke ovens, and they had, indeed, been agreeably surprised by its small quantity. The two kinds of joint were for two types of main. The Johnson couplings were used on steel mains where a flexible joint was required.

Mr. **V. J. J. Siddons** (Barnsley) said he believed most people in the Industry were not much in favour of self-acting syphons, and he would be interested to know whether they were proving satisfactory on the grid. Were the flexible joints machine-faced? Was the whole of the testing of the mains supervised by the gas undertaking and was everything exposed?

Mr. **Roberts** agreed that automatic syphons were not so positive on low-pressure as on a high-pressure main. In this case they were working at high pressure—up to 30 lb. per sq. in.—throughout most of the system, dropping down to perhaps 10 lb. per sq. in. only at the limits. They were working quite satisfactorily. In regard to the flexible joints; the spigot end of specials was machined and the joint ring had a lead tip on it. The testing was under the undertaking's supervision. Occasionally, on the first test they found split bodies, which might have been due to the pipe showing a fault under prolonged stress or it might have been a split spigot. These were rectified and a second test was made.

Mr. **J. Richmond** (York) remarked that local gas undertakings would not necessarily require the same quantity of gas all at the same time, and asked what was the method of storage on the scheme.

Mr. **Roberts** said they had a schedule of estimated weekly requirements from each undertaking, and from these figures they could supply quantities at a fixed rate according to the figures to keep the undertakings' holders supplied within safe limits.

Mr. **A. Pickard** (Knottingly) said that he had himself been associated with one of the undertakings in the scheme for some time and could appreciate the many difficulties encountered. Referring to hatch boxes he asked what would happen in the event of a stoppage.

Mr. **Roberts** said that stoppage in the trunk main would not be sudden. There would be evidence of restricted supplies; and arrangements could be made to have the main closed down for a period convenient to the undertakings to investigate any such stoppage.

Mr. **J. Castle** (Brighouse) asked if the gas was purified for sulphuretted hydrogen before being put into the grid, and was it passed through a gas-drying plant? If so, how often were the syphons emptied at a point near the coke ovens?

Mr. **Roberts** replied that the gas was purified at the coke ovens to a high specification. He was not familiar with details of the plant at the coke ovens and, therefore, could not say whether it was passed through a gas-drying plant or not. Experience in regard to condensation under high-pressure systems seemed to vary. The first syphon on the trunk main was blown daily.

Mr. **A. W. Reid** (Leeds) remarked that Mr. Roberts gave the P.H. value—which was constant all the way along—while he also had the ohmic resistance and sulphate figures. Which of the three would be the determining factor?

Mr. **Roberts** said that if they were investigating for a proposed main they would test for electrical resistivity. If this indicated a low ohmic resistance the presence of aggressive salts would be suspected and an analysis of the water soluble extract would be made to ascertain the corrosive agent. In this part of the country calcium and magnesium sulphates were the commonest corrosive agents.

Mr. **J. E. Lister Cooper** (Yeadon) said the Paper showed plainly how well this grid main-laying job had been done. It was a scheme the development of which would be watched with the utmost interest. With regard to the test made on the ground for electrical resistivity, acidity, &c., it would be interesting to know what the promoters would have done had they come upon ground which was entirely unsuitable in tnese various respects.

Mr. **Roberts** stated that the main would be carried on concrete piers over the top of the ground where possible. For pipes that had to be buried a coating would be applied, specially prescribed to withstand the aggressive agents present in the soil.

Mr. **A. P. Jennings** (Leeds) asked if there had yet been any sign of need for readjustment of the steel main tubes on the adjustable brackets over the waterlogged stretch of colliery subsidence land; and, if so, had the readjustment been made without any unexpected difficulties?

Mr. **Roberts** observed that the question of colliery subsidence was a very interesting and important matter in main laying in such an area, and it was desirable that those responsible for a scheme should be sufficiently familiar with the area to know where subsidences might be likely. Subsidence of this kind did not usually occur suddenly, but it was necessary to make periodical inspections at points of likely ground movement and, if necessary, take remedial measures before further subsidence occurred. In the particular case mentioned no readjustment had yet been required. In reply to a further question, Mr. Roberts said that no allowance was made for atmospheric pressure on testing. Differences in atmospheric pressure was not shown in relation to high-pressure testing.

A vote of thanks to Mr. Roberts for his Paper was accorded on the motion of Mr. **Carlton,** seconded by Mr. **C. J. Broome** (Cleckheaton).

Yorkshire Junior Gas Association

Meeting at Leeds

A meeting of the Yorkshire Junior Gas Association was held on March 30 at the Meadow Lane Gas-Works, Leeds, with Mr. T. G. Lewis (the President) presiding.

Mr. L. W. Roberts, of the West Yorkshire Gas Distribution Company, delivered a highly interesting Paper—illustrated by lantern slides—describing work and experiences in the laying of the West Yorkshire Gas Grid (completed last October). This Paper, together with a report of the discussion which followed, will be found on other pages of this week's "JOURNAL."

The meeting was followed by a tour of the Meadow Lane works to inspect especially certain plant installed in recent times and since the Association's last previous visit there.

Among those present were Mr. C. S. Shapley (Engineer and Manager of the Leeds Gas Department), Mr. J. E. Lister Cooper (Yeadon), Mr. Cawthorne, of Clayton, Sons, & Co., Ltd., who attended to present the annual Clayton Award for the best Paper to the Yorkshire Association in the previous session, and Mr. R. N. Webb, former Works Manager at Meadow Lane and recent President of the Manchester District Association.

Mr. Cawthorne, acting in the unavoidable absence of Mr. Hartley, presented to Mr. W. S. Hubbard, Works Manager at Meadow Lane, the annual Clayton Medal for the best Paper delivered in the previous session to the Yorkshire Junior Association. Mr. Hubbard's Paper, "Choice of Gas Storage," had also secured for its Author the Bronze Medal of the Institution of Gas Engineers and the Silver Medal of the Society of British Gas Indus-

tries, and Mr. Hubbard was warmly complimented on this triple recognition of his contribution to the Industry's Transactions.

A.R.P. on the Works

The members were then divided into parties for a tour of the Meadow Lane works under guidance of the President of the Association (Mr. Lewis), Mr. Hubbard (Works Manager) and members of the staff.

The vertical retort house at the Meadow Lane Works is capable of producing 8 million cu.ft. of gas per day from nine beds of Glover-West 33 in. retorts and nine beds of 50 in. retorts, five of the latter being fitted with breeze-burning producers. Three horizontal tube boilers deal with the waste heat from the settings, the largest having an output of 10,000 lb. of steam per hour. The coal and coke handling plant is arranged in duplicate at the end of the retort house.

Passing through an air-lock from the retort house the visitors found themselves in an extensive A.R.P. shelter, constructed by the adaptation of an old inclined retort house waste gas flue. The shelter is a tunnel 115 ft. long, 10 ft. below ground level and protected by a 5 ft. thick arch of brick and reinforced concrete, and by 20 ft. of coal. Designed to accommodate 100 men, the shelter has an ambulance room and dressing station.

The visitors also inspected a reinforced concrete air-raid shelter to hold 70 men. Due to its specially constructed roof, embodying shock-proof principles, the shelter is considered safe against a direct hit from a small bomb. All the shelters are wired for communication with the "master" shelter situated under the offices. The Leeds Gas Department, in conjunction with other public service departments in the city, has personnel trained to deal with any emergencies due to war conditions, and a feature of the Transport Depot was two completely equipped A.R.P. motor wagons. The base of the 5¼ million holder is protected against high explosive blast by using the surrounding ground as a storage place for steel pipes.

The benzole plant, capable of stripping 8 million cu.ft. of gas per day, was then inspected, and subsequently the various maintenance shops were visited. In the main tar and liquor pump room a water borehole was seen in course of construction. The final point on the tour was the laboratory, fully equipped to deal with any gas-works problems that might arise, and including also a coal test plant to carbonize 1/100th of a ton.

After the visit tea was served in the works canteen, by courtesy of Leeds Gas Committee.

On the motion of Mr. V. J. J. SIDDONS (Barnsley), seconded by Mr. A. PICKARD (Knottingley), thanks were accorded to the Leeds Gas Committee and to Mr. Shapley for facilities for the meeting and works tour, and for the refreshments provided.

Gas Undertakings Results

Bridgwater

Sales by the Bridgwater Gas Light Company during the year 1939 amounted to close upon 166 million cu.ft., which compares with a total of a little over 166¼ million cu.ft. in 1938. Continued and increasing progress was made by the Company up to September, after which the substantial lighting load naturally suffered severely. The "black-out" conditions not only affected public lighting, but, because of the earlier closing hours, reduced the quantity of gas used for the lighting and heating of shops and other buildings. During the year the number of customers increased by 177. The final result of the year's trading shows a small increase in the balance carried to Net Revenue Account, but after allowing for fixed charges and the dividend recommended (7½% for the year, as before) the sum remaining to be carried forward is less by £1,417 than was the case a year ago.

Luton

In spite of the adverse conditions prevailing during the latter part of the year, the Luton Gas Company added 670 to the number of consumers on their books in 1939, while sales of gas were more by 171,189 therms (34,936,200 cu.ft.), or 3.41%, than in the preceding twelve months. The balance carried to Net Revenue Account is £16,791, as compared with £15,287 a year ago, and dividends are as in previous years—namely, 8¾% for the year on the consolidated ordinary stock "A," and 7¼% on the consolidated ordinary stock "B." Increased costs necessitated a rise in the price of gas as from Jan. 1 of this year from 9d. to 10d. per therm. As recorded in the "Personal" column of the "JOURNAL," Mr. William Phillips (the General Manager, Engineer, and Secretary) has now been with the Company for more than fifty years, and his son, who has now joined his father as Personal Assistant represents the fourth generation of the Phillips family to serve the Company.

Buenos Aires

In their report for the year 1939 the Directors of the Primitiva Gas Company of Buenos Aires, Ltd., state that the balance of Revenue Account, converted at par of exchange, amounts to £531,746, and after providing for the various charges detailed in the Profit and Loss Account there remains (with £77,634 brought forward from 1938) the sum of £239,076. After placing £100,000 to depreciation and renewals reserve and £10,000 to contingencies reserve, and the payment of a dividend of 1¾% free of income-tax, there will remain to be carried forward a balance of £76,585. A year ago the dividend was 2½%, free of income-tax, and the carry forward £77,634. Currency revenue at par of exchange again shows an improvement on the figures of the previous year. The Municipality have authorized the Company to supply gas to the city until Aug. 15 next, under the terms of the 1920 contract.

Wells

An increase in sales of gas during the past year is reported by the Wells (Somerset) Gas Light Company. Actually, the quantity sold was 45,581,600 cu.ft., which is an increase of 1.58% on the preceding twelve months. The balance of revenue carried to Profit and Loss Account is £3,514, as against £3,687 a year ago. The year's working shows a net profit of £1,266. A dividend of 5% for the year (the same as for 1938), and the placing of £130 to Renewal Fund Account, will leave to be carried forward the sum of £1,540, as against £1,532 a year ago.

Trading Results in 1939

Worthington-Simpson, Ltd.

The profit on trading for the year by Messrs. Worthington-Simpson, Ltd., including income from investments, amounted to £98,664—an increase of £40,239 on the previous year. After deducting depreciation, Directors' fees, interest on debentures, and provision for taxation, there remains a net profit of £37,240, against £26,256 for the year 1938. While the trading profit shows a very substantial increase on the preceding year, the difference in the net profit is, of course, much less, due to the additional provision that has to be made for excess profits tax and income-tax. A further £10,000 has been transferred to general reserve, which now stands at £25,000. After making provision for the full year's dividend on the preference shares and the dividend of 10%, less tax, recommended on the ordinary shares, £19,327 is left to be carried forward.

Valor Company, Ltd.

Steps taken to broaden the scope of the Company's activities were referred to by the Chairman at the annual general meeting of the Valor Co., Ltd. There was a misconception in the minds of the public that the Valor Company were entirely devoted to the manufacture of oil-consuming devices; this was not correct. The Company manufactured a multiplicity of articles, a few of which were: Oil filters, oil measures, transport cans and funnels, works steel fittings and lockers, office steel equipment and furniture, sanitary and engineers' brassware, and hot brass pressings. Their financial position had enabled them to buy in good markets the raw materials, and provision of raw materials in advance had proved of great benefit, and they could say to-day that the executive and Directors were working day and night to keep pace with the public demands for the Company's products. The net profits for the year of £34,545 showed an increase over those of the previous year of £14,529.

Synthetic Oils, Ltd.

It was stated by the Chairman at the eighth annual meeting of Synthetic Oils, Ltd., that rights and patent expenditure stood in the balance-sheet at £10,550. That was the major asset of the Company, and the reports of experts on their patent situation were very satisfactory. They were continuing research; details were being developed and improved, and they had every reason to be satisfied with the progress their technical staff were making. On the business side they were in touch with many groups and companies at home and abroad, and sooner or later they hoped to announce progress in that direction. There was, however, more in front of them than a successful method of getting "oil from coal." The Chairman quoted from a well-known authority as follows: "This type of process is entirely new to this country, and though at the present time the primary object is to convert coal into liquid fuels, the establishment of an industry based on this reaction should make it possible in the future to extend into other fields." Continuing, the Chairman said he felt that while they might, as they hoped, have reached the stage of commercial success in the production of oil from coal, they had only just opened the gate into a field, which lay unexplored, where the knowledge they had gained during the development of their synthetic oils process over the last few years would prove to be of great value in other developments. This country would badly need new industries when the war was over, and they hoped to be able to give considerable help in that direction.

Trade News

Belt Conveyors

A leaflet from Hugh Wood & Co., Ltd., Team Valley Trading Estate, Gateshead-on-Tyne, describes the rigid straight-line (Type "FGT") section of the "Huwood" fully-troughed bottom belt gate conveyor to deal with large capacities. The whole 12 ft. section is light enough to be carried by two men, but to facilitate easy and quick transport it can be dismantled into parts so as to reduce the bulk. The rollers are of the "Huwood" patent oil-filled type.

Pressure Gasholders

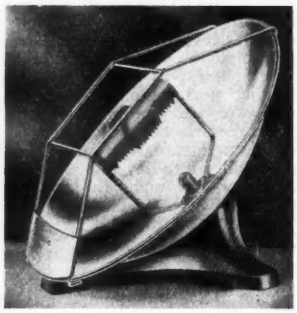
An attractive brochure has been issued by the Whessoe Foundry and Engineering Co., Ltd., Darlington, illustrating a wide diversity of pressure gasholders erected by the Company both in this country and overseas. Pressure holders are normally built in units from 10,000 to 250,000 cu.ft. releasable capacity, and the pressures are usually from 50 to 70 lb. per sq. in., though higher pressures may be used in certain cases. Used with high-pressure distribution systems to provide necessary storage, and with low-pressure systems for improving district pressures, they are of heavy plate construction, and the horizontal type may be protected against war conditions by rendering them blast proof and completely invisible from the air. As the cost is relatively independent of the number of units, one holder, either cylindrical or spherical, may be installed initially, and others added without sacrifice of cost as they are needed.

Office and Works Clocks

Exact time-keeping was never more necessary in industry than it is to-day, and a catalogue of clocks for office and works from the Synchromatic Time Recording Co., Ltd., Erskine Street, Liverpool, is, therefore, of topical interest. Besides electric clocks and signal cabinets for controlling start and stop work signals, mention is made of the "Synchromatic Perpetual" watchman's control clock. The Company also has an extensive A.R.P. department for the supply of gas masks, anti-gas clothing, &c.

A New Radiation Portable Heater

Springtime presents its own especial heating problems, for at this time of the year the noonday thermometer readings are just about double those of the early morning and late evening, and there is an intermittent demand for means of raising the room temperature for breakfast and supper. The demand is met by Radiation's new small portable "Dixie" gas heater, which provides the required warmth on extremely economical terms, both as regards the initial cost of the heater and the gas consumption. Standing 7½ in. high and with a bowl 9¾ in. in diameter, the "Dixie" produces from its highly polished reflector a concentrated beam of cheerful radiant heat, and it can be plugged in to any convenient gas point in the house. Its beam can be directed wherever it is most needed, and a strong selling point in its favour is that as the heater gives about two hours' heat for a pennyworth of gas, at average prices, it can play its part in home economy.



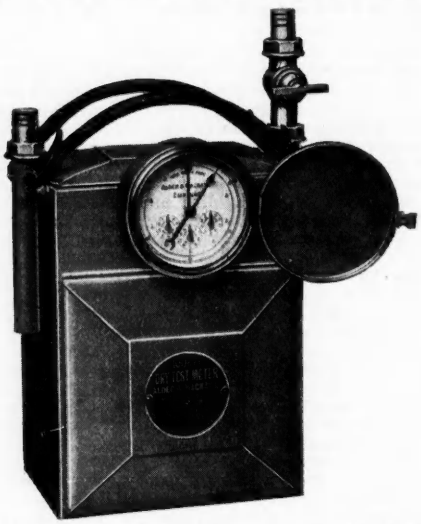
"Danger Signals"

"Danger Signals" is the arresting title of a folder from Rotherham & Sons, Ltd., of Coventry, describing some of the Company's oil indicators which have been very widely used, tested and proved reliable under many exacting conditions. It has been said that the value of maintaining an oil supply may be measured by the cost of repairing the damage after its failure. By such standards, be the installation large or small, the cost of providing safeguards in the circuit is insignificant; the important point is the reliability of the units employed, and it is upon relability that the Company's reputation has been built. Five types of indicators are described, but they are only a selection from the complete range. The folder also illustrates components produced by the instrument department, particularly industrial clocks. Nine different standard types are illustrated, and a wide range of chart and base fixings is available.

There is no better way of searching out faulty meters than house to house testing with an

"A & M"

DRY TEST METER



"A & M" Dry Test Meters are made in 40, 100 and 200 cubic feet sizes—the 40 cubic feet size weighing only 13½ lbs. Leather handles are fitted for ease of carrying.

The pointer shows the hourly rate by a minute's observation on the outer circle and 1 cubic foot in 100th parts on the inner.

We also manufacture Dry Demonstration Meters for Showroom use.

ALDER & MACKAY LTD.

EDINBURGH - LONDON - BRADFORD & BRANCHES

Current Sales of Gas Products

The London Market

April 15.

To-day's market prices of tar products are as under:

Pitch 50s. per ton f.o.b.
Creosote 5d. per gallon.
Refined tar 3¾d. to 4d. per gallon.
The price of pure toluole under the Ministry of Supply Order is just under 2s. 5d. per gallon.
Pure benzole 1s. 10d.
95/160 solvent naphtha 1s. 11d.
90/160 pyridine 16s. to 17s.
All per gallon naked.
Refined naphthalene crystals about £20 per ton in bags.
All *ex* makers' works.

The Provinces

April 15.

Crude Gas-Works tar, 27s. 9d. to 32s. 9d.

To avoid misunderstanding, it is necessary to state that the above price is not claimed to represent a market value. It is a price worked out from week to week upon a system which has been used for many years as a basis for the fixing of certain contracts for crude tar of varying qualities in different areas.

The average prices of gas-works products during the week were: Pitch—East Coast, 47s. 6d. to 52s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 47s. 6d. to 52s. 6d.* Toluole, naked, North, 1s. 9½d. (Controlled by the Ministry of Supply Order No. 1, which fixes the maximum price at which this material may be sold). Coal tar, crude naphtha, in bulk, North, 9d. to 9½d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 9d. Heavy naphtha, North, 1s. 4½d. to 1s. 5½d. Creosote, *ex* works, in bulk, North, liquid and salty, 4½d. to 4¾d.; Scotland, 4¼d. to 4¾d.; low gravity, 4¼d. to 4¾d. Fuel Grade, 4d. to 4¼d. Carbolic acid, 60's, 3s. 6d. to 3s. 7½d. Naphthalene, £15 to £20. Salts, 75s. to 85s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal. Heavy oil: Unfiltered anthracene oil, (min. gr. 1,080), 5¼d. to 5½d.; filtered heavy oil (min. gr. 1,080), 5¾d. to 6d.; heavy anthracene oil gr. less than 1,080, 6d. to 6¼d.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls, whatever they may be.

Scotland

GLASGOW, April 13.

A moderate volume of new business has been placed for prompt and early delivery. Business for forward delivery is, however, not easily arranged.

Crude gas-works tar.—Actual value is now 39s. to 40s. per ton *ex* works in bulk.

Pitch.—Stocks are down to a minimum and prices are now higher at about 40s. per ton f.o.b. for export and about 37s. 6d. per ton *ex* works in bulk for home trade.

Refined tar.—For delivery in the home market price is at present fixed at 4¼d. to 4½d. per gallon, and for export supplies are now quoted at 3d. to 3¼d. per gallon, both f.o.r. naked.

Creosote oil.—Plentiful supplies of most grades are available and prices are unchanged as follows: Specification oil, 5d. to 5¼d. per gallon; low gravity, 6¼d. to 6½d. per gallon; neutral oil, 5¼d. to 5¾d. per gallon; all *ex* works in bulk.

Cresylic acid.—Competition is keen with supplies available as under: Pale, 97/99%, 2s. 1d. to 2s. 3d. per gallon; dark, 97/99%, 1s. 10d. to 2s. per gallon; pale, 99/100%, 2s. 6d. to 2s. 9d. per gallon; all *ex* works in buyers' packages.

Crude naphtha.—Production is small and readily commands about 8d. to 8½d. per gallon *ex* works in bulk, according to quality.

Solvent naphtha remains steady with 90/160 grade at 1s. 8d. to 1s. 9d. per gallon and 90/190 heavy naphtha at about 1s. 4d. to 1s. 5d. per gallon.

Motor benzole is 1s. 6¼d. to 1s. 7d. per gallon.

Pyridine.—Prices are nominal at 18s. to 19s. per gallon for 90/160 grade and 20s. to 21s. per gallon for 90/140 grade.

Contracts Advertised

Painting Gasholders.
Carlisle Gas Department. [p. 158.]

Paint for Gasholders.
Carlisle Gas Department. [p. 158.]

Conversion Gas Lighting Units A.R.P.
Blackpool Gas Department. [p. 158.]

Trading Results in 1939

Lancashire Dynamo & Crypto, Ltd.

In the course of his speech to the proprietors of Lancashire Dynamo & Crypto, Ltd., the Chairman, Mr. A. E. L. Chorlton, C.B.E., M.P., M.I.E.E., said that the profit for the year was £131,000, which, with the balance brought forward, gave £224,000 for disposal. Including the interim dividend, the distribution for the year was a dividend of 15% with a bonus of 5%. The carry-forward was increased by £6,000 to £99,000. The Company commenced the year 1940 with record order books. Future results would depend largely upon the availability of adequate raw materials. The whole resources of the Company were at the disposal of the Government and all works were occupied with Government work or export trade. The Company had more export orders offered to them than they had been able to handle, and unless greater supplies of raw materials were made available it was difficult to see how exports could be increased.

A.R.P.
PROTECTION OF SANDBAGS.

METRO CREOSOTE EMULSION

METRO COPPER CREOSOTE EMULSION

Both Emulsions conform to the Specification of the Ministry of Home Security Memorandum A.R.P. 279/1939 — 20/10/39, and are available in GREEN at slight additional cost.

SOUTH METROPOLITAN GAS CO.

REGIS HOUSE,
KING WILLIAM STREET,
E.C.4.

Telephone: AVENUE 2755.

For every size of works and every class of coal...

WEST'S

CARBONIZING PLANTS

GLOVER-WEST VERTICALS

WESTVERTICAL CHAMBERS

440 carbonizing plants have been built or are under construction by West's in 24 countries. Working results from a wide variety of gas coals have established the high efficiency and adaptability of the West systems.

WEST'S

GAS IMPROVEMENT CO · LTD ·

MILES PLATTING MANCHESTER 10

TELEPHONE—COLLYHURST 2961-2-3-4-5 · TELEGRAMS—STOKER, MANCHESTER

LONDON OFFICE TEMPORARY ADDRESS—BATH ROAD · HARMONDSWORTH · WEST DRAYTON · MIDDLESEX TEL.—WEST DRAYTON 2280-9

GAS STOCKS AND SHARES

The first somewhat depressing news of the Scandinavian situation led to cautionary marking down of prices on Wednesday of last week. On Thursday, however, markets steadied and values in many sections were almost back to their former levels, but the brighter conditions were not sustained and business became dull again on Friday. By the close British Funds had recovered some of their earlier losses although many were very little above the minimum prices. 2½% Consols closed ½ down on the week at 72. Home rails were particularly weak, the demand for further wage increases being an additional adverse factor in their case. Business among industrials was small although most finished the week above the lowest touched on Wednesday. Oil shares were steady and some activity continued among gold mining shares.

The general situation had little affect on the Gas Market. The volume of business was by no means negligible, and over all the lists, apart from ex. div. reductions, there were more gains than losses. The only stocks which can be said to have reacted in sympathy with the position were Gas Light units which closed 3d. lower at 16s. 9d. Imperial Continental with a drop of 3 points to 75½, and South Metropolitan which was a point down at 71½. Among the gains in the official List appeared Plymouth and Stonehouse with a rise of 4 to 120½, and a few fixed-interest stocks, while in the Provinces Liverpool closed 1 higher and Newcastle units 4½d. better than a week ago. In the Supplementary List it will be seen that Lea Bridge 4% debenture hardened 5 to 82½, which is still on the low side.

Among the week's dividend announcements appeared the following: Bombay, a final of 4½% making 8% for the year; Oriental, an interim of 3½%, less income tax (as against free of tax for 1939), for the year ending June 30 next, and South Western Gas and Water a final of 3% making 5% for the year. All these rates are the same as for the corresponding period a year ago.

Official Quotations on the London Stock Exchange

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 12.	Rise or Fall on Week.
1,767,439	Mch. 11	8	7	Alliance & Dublin Ord. ...	108—113	...
374,000	Dec. 27	4	4	Do. 4 p.c. Deb. ...	80—90	...
877,576	Nov. 6	5	5	Ascd. Gas & Water U'd'ts Ord.	14/6—16/6	...
500,000	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	16/6—18/6	...
535,545	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	15/—17/—	...
318,730	,,	4	4	Do. 4 p.c. Irred. Cum. Pref.	13/6—15/6	...
750,000	Mch. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	82—87	...
560,070	Feb. 19	7	7	Barnet Ord. 7 p.c.	122—127	...
300,000	Apl. 8	1/4⅜	1/9⅜	Bombay, Ltd.	19/6—21/6*	—/6
181,915	Feb. 26	9½	9½	Bournemouth Sliding Scale ...	145—150	...
690,526	,,	7	7	Do. 7 p.c. max. ...	118—123	...
493,960	,,	6	6	Do. 6 p.c. Pref. ...	116—121	...
50,000	Dec. 18	3	3	Do. 3 p.c. Deb. ...	70—75	...
362,025	,,	4	4	Do. 4 p.c. Deb. ...	95—100	...
335,000	,,	5	5	Do. 5 p.c. Deb. ...	105—110	...
357,900	Feb. 19	7½	6½	Brighton, &c., 6 p.c. Con. ...	103—108	...
659,955	,,	6½	5⅞	Do. 5 p.c. Con. ...	100—105	...
205,500	,,	6	6	Do. 6 p.c. 'B' Pref. ...	103—108	...
855,000	Mch. 11	7	8	British Ord.	98—108	...
100,000	Dec. 18	7	7	Do. 7 p.c. Pref.	120—125	...
350,000	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...
120,000	,,	4	4	Do. 4 p.c. Red. Deb.	75—80	+2
450,000	,,	5	5	Do. 5 p.c. Red. Deb.	100—105	...
100,000	22 May '33	6	4	Cape Town, Ltd.	½—¾	...
100,000	6 Nov. '33	4½	4½	Do. 4½ p.c. Pref.	½—¾	...
150,000	Dec. 18	4½	4½	Do. 4½ p.c. Deb.	53—58	+½
626,860	Jan. 29	6	5⅛	Cardiff Con. Ord.	103—108	...
237,860	Dec. 18	5	5	Do. 5 p.c. Red. Deb. ...	95—100	...
98,936	Apl. 8	2/—	2/—	Colombo Ord.	1½—1¾*	...
24,510	,,	1/4½	1/4½	Do. 7 p.c. Pref.	20/—22/—*	—/6
739,453	Mch. 26	—/11.48	—/11.48	Colonial Gas Assn. Ltd. Ord. ...	14/6—16/6	...
296,144	,,	1/3.30	1/3.30	Do. 8 p.c. Pref.	20/—22/—	...
1,775,005	Jan. 29	4	2	Commercial Ord.	47—52	...
140,000	Feb. 19	4	4	Do. 4 p.c. Red. Pref. ...	87—92	...
620,000	Dec. 11	3	3	Do. 3 p.c. Deb.	62—67	...
286,344	Feb. 19	5	5	Do. 5 p.c. Deb.	95—100	...
200,000	,,	3⅜	3⅜	Do. 3⅜ p.c. Red. Deb. ...	93—98	...
807,560	Feb. 12	7	7	Croydon sliding scale	98—103	...
644,590	,,	5	5	Do. max. div.	84—89	...
620,385	Dec. 7	5	5	Do. 5 p.c. Deb.	100—105	...
208,660	Feb. 19	5	5	Dudley, Brierley Hill & Dist. Ord.	98—103	...
82,275	,,	5	5	Do. 5 p.c. Con. Pref. ...	93—98	...
79,000	,,	3⅜	3⅜	Do. 3⅜ p.c. Red. Deb. ...	93—98	...
239,000	Jan. 29	5	88/6	East Hull Ord. 5 p.c.	70—80	—10
187,215	Feb. 12	5⅜	5⅜	East Surrey Ord. 5 p.c. ...	93—98	...
176,211	Dec. 18	5	5	Do. 5 p.c. Deb. ...	100—105	...
250,000	Nov. 13	8	4	Gas Consolidation Ord. 'B' ...	14/—17/—	...
250,000	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	16/—18/—	...
19,152,410	Jan. 29	5⅜	3⅜	Gas Light & Coke Ord. ...	16/3—17/3a	—/3
2,600,000	,,	3½	3½	Do. 3½ p.c. max.	62—67	...
4,477,106	,,	4	4	Do. 4 p.c. Con. Pref. ...	86—91	...
2,993,000	Jan. 2	3⅜	3⅜	Do. 3⅜ p.c. Red. Pref. ...	87—92	...
8,602,497	Nov. 27	3	3	Do. 3 p.c. Con. Deb. ...	77—82	...
3,642,770	,,	5	5	Do. 5 p.c. Red. Deb. ...	105—110	...
3,500,000	,,	4¼	4¼	Do. 4¼ p.c. Red. Deb. ...	102—107	...
700,000	Mch. 11	3½	3½	Do. 3½ p.c. Red. Ded. ...	87—92	...
270,466	Feb. 19	6	6	Harrogate New Cons.	93—98	...
157,500	Apl. 8	‡1/—	‡1/—	Hong Kong and China Ord. ...	½—¾*	...
5,600,000	Oct. 23	12	4	Imperial Continental Cap. ...	73—78	—3
172,810	Jan. 29	3½	3½	Do. 3½ p.c. Red. Deb. ...	80—85	...
63,480	Dec. 18	3	3	Maidstone 3 p.c. Deb.	55—60	...
45,000		†10	†8	Malta & Mediterranean ...	92—102	...
				Metropolitan (of Melbourne) ...		
392,000	Apl. 1	5½	5½	5½ p.c. Red. Deb.	93—98	...
231,977	Feb. 19	5	5	M.S. Utility 'C' Cons.	75—80	...
968,658	,,	4	4	Do. 4 p.c. Cons. Pref. ...	82—87	...
390,076	Dec. 18	4	4	Do. 4 p.c. Deb. ...	85—90	...

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 12.	Rise or Fall on Week.
148,955	Dec. 18	5	5	M.S. Utility 5 p.c. Deb. ...	103—108	+1
125,000	Jan. 2	3½	3½	Do. 3½ p.c. Red. Bds. ...	90—95	...
675,000	Nov. 6	†3	†4	Montevideo, Ltd.	60—65	...
250,000	Mch. 18	7½	5⅛	North Middlesex 6 p.c. Con. ...	103—108	...
396,160	Jan. 29	5	5	Northampton 5 p.c. max. ...	90—95	...
300,000	Nov. 6	†7	9	Oriental, Ltd.	115—120	—3
468,537	Dec. 11	8	7	Plymouth & Stonehouse 5 p.c.	118—123	+4
621,667	Feb. 5	8½	8⅛	Portsmouth & Gosport Cons.	110—115	...
241,446	,,	5	5	Do. 5 p.c. max.	85—90	...
73,350	,,	5	5	Do. 5 p.c. Pref.	90—95	...
75,000	,,	4	4	Do. 4 p.c. Pref.	75—80	...
114,000	Feb. 5	5	5	Preston 5 p.c. Pref.	88—93	...
247,966	Dec. 18	4	4	Primitiva 4 p.c. Cons. Deb. ...	93—98	...
625,959	Jan. 15	4	4	Do. 4 p.c. Red. Deb. ...	91—96	...
15,000	Mch. 11	6	6	San Paulo 6 p.c. Cum. Pref. ...	7⅛—8½	...
441,275	Oct. 9	1/1⅛	1/1⅛	Severn Val. Gas Cor. Ld. Ord.	17/—19/—	...
460,810	Mch. 11	—/10⅝	—/10⅝	,, ,, 4½ p.c. Cum. Pref. ...	16/6—18/6	...
133,201	Feb. 12	8½	5	Shrewsbury 5 p.c. Ord. ...	105—115	...
9,000	June 5	†4	†4	South African Ord.	4—5	...
1,996,297	Aug. 21	1/2⅜	1/2⅜	South East'n Gas Cn. Ld. Ord.	16/—18/—	...
1,000,000	Mch. 4	—/10⅜	—/10⅜	Do. 4½ p.c. Red. Cum. Pref.	16/6—18/6	...
769,191	,,	4	4	Do. 4 p.c. Cum. Pref. ...	15/—17/—	...
450,000	Feb. 12	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...
150,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	89—94	...
6,709,895	,,	5	4	South Met. Ord.	69—74	—1
1,135,812	,,	6	6	Do. 6 p.c. Irred. Pref. ...	106—111	...
850,000	,,	4	4	Do. 4 p.c. Irred. Pref. ...	80—85	...
1,895,445	Dec. 27	3	3	Do. 3 p.c. Deb.	71—76	...
1,000,000	Jan. 15	5	5	Do. 5 p.c. Red. Deb. ...	102—107	...
600,000	,,	3¼	3¼	Do. 3¼ p.c. Red. Deb. ...	92—97	...
1,543,795	Feb. 5	6	3	South Suburban Ord. 5 p.c. ...	77—82	...
512,925	,,	5	5	Do. 5 p.c. Pref.	95—100	...
500,000	,,	4	4	Do. 4 p.c. Pref.	82—87	...
250,000	,,	3⅜	3⅜	Do. 3⅜ p.c. Red. Pref. ...	86—91	...
888,587	Dec. 11	5	5	Do. 5 p.c. Deb.	105—110	...
250,000	,,	4	4	Do. 4 p.c. Deb.	85—90	...
200,000	Feb. 12	3½	3½	Do. 3½ p.c. Red. Deb. ...	87—92	...
427,859	Sept. 18	1/2⅜	9⅜	S. Western Gas & Water Ord.	13/6—15/6	...
160,523	Oct. 9	—/10⅜	—/10⅜	Do. 4½ p.c. Red. Cum. Pref.	17/—19/—	—/6
110,000	Dec. 18	4	4	Do. 4 p.c. Red. Deb. ...	90—95	...
750,541	Feb. 5	5	5½	Southampton Ord. 5 p.c. ...	77—82	...
148,836	Dec. 27	4	4	Do. 4 p.c. Deb.	85—90	...
350,000	Feb. 12	5½	5½	Swansea 5½ p.c. Red. Pref. ...	97—102	...
200,000	Dec. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—100	...
1,076,490	Feb. 26	6½	5	Tottenham and District Ord....	94—99	...
409,835	,,	5½	5½	Do. 5½ p.c. Pref.	103—108	...
62,235	,,	5	5	Do. 5 p.c. Pref.	95—100	...
453,380	Dec. 11	4	4	Do. 4 p.c. Deb.	85—90	...
1,247,505	Oct. 23	6	4	U. Kingdom Gas Cor. Ord. ..	14/—16/—	...
1,085,952	Nov. 20	4½	4½	Do. 4½ p.c. 1st Cum. Pref. ...	15/—17/—	...
772,709	,,	4	4	Do. 4 p.c. 1st Red. Cum. Pf.	14/6—16/6	...
745,263	Dec. 18	4½	4½	Do. 4½ p.c. 2nd Non-Cum. Pf.	13/6—15/6	...
1,093,656	Mch. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	84—89	...
378,106	Mch. 11	7	7	Uxbridge, &c., 5 p.c.	95—105	...
133,010	,,	5	5	Do. 5 p.c. Pref. ...	95—100	...
1,371,138	Feb. 5	6½	3½	Wandsworth Consolidated ...	88—93	...
2,525,768	,,	4	4	Do. 4 p.c. Pref.	84—89	...
1,343,964	Dec. 18	5	5	Do. 5 p.c. Deb.	103—108	...
383,745	,,	4	4	Do. 4 p.c. Deb.	85—90	...
400,000	,,	3¾	3¾	Do. 3¾ p.c. Red. Deb. ...	90—95	...
558,342	Jan. 29	6⅛	6	Watford and St. Albans Ord. ...	95—100	...
200,000	,,	5	5	Do. 5 p.c. Pref.	95—100	...
200,000	,,	5½	5½	Do. 5½ p.c. Pref.	100—105	...
200,000	,,	4	4	Do. 4 p.c. Rd. Pf. (1973/8)	85—90	...
100,000	,,	33/4§	4	Do. 4 p.c. Red. Pf. (1959)	93—98	...
200,000	Dec. 11	3½	3½	Do. 3½ p.c. Red. Deb. ...	83—88	...

a.—The quotation is per £1 of Stock. * Ex. Div. † Paid free of income-tax. ‡ For year. § Actual.

Supplementary List and Provincial Exchanges overleaf.

STOCK AND SHARE LIST—Contd.

Supplementary List, not Officially Quoted, London

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Nominal Quotations Apl. 12.	Rise or Fall on Week
202,152	Mch. 18	5	5	Ascot Ord.	80—85	...
128,182	Dec. 27	5	5	Do. 5 p.c. Pref. ...	88—93	...
31,035	Mch. 4	-/9⅝	-/9⅝	Associated Utilities 4 p.c. Pref.	15/—17/-	...
100,000	Dec. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—95	...
17,000	Feb. 19	8	8	Bognor Orig. Ord. 'A' ...	102—112	...
62,210	,,	8	8	Do. New Add. 'A' ...	102—112	...
87,160	,,	7	7	Do. New 7 p.c. max. ...	95—105	...
37,440	Jan. 29	10	10	Cam. Univ. & Town 10 p.c. max.	145—155	...
125,970	,,	7	7	Do. 7 p.c. max.	105—115	...
39,025	,,	5	5	Do. 5 p.c. max.	80—90	...
96,410	Jan. 29	4½	4½	Cardiff 4½ p.c. Pref.	90—95	...
55,520	Feb. 19	6	6	Colchester 6 p.c. Pref. ...	95—100	...
90,550	Mch. 18	5	5	Do. 5 p.c. Deb. ...	98—103	...
150,000	Feb. 12	4	4	Croydon 4 p.c. Pref.	82—87	...
130,000	Dec. 27	4	4	Do. 4 p.c. Deb.	85—90	...
65,000	Mch. 4	7½	6⅞	Eastbourne 'A' 5 p.c.	105—115	...
198,000	,,	6	5⅞	Do. 'B' 3½ p.c.	90—100	...
112,312	,,	5	5	Do. 5 p.c. Pref.	90—95	...
130,000	Dec. 18	5	5	Do. 5 p.c. Deb.	98—103	...
130,500	Feb. 19	7½	7½	Exeter New Ord. (£10) ...	10—12	...
24,000	Aug. 21	8½	8½	Gt. Yarmouth 8½ p.c. max. (£30)	15—20	...
59,400	,,	7½	7½	Do. 7½ p.c. max. (£30) ...	10—15	...
51,160	Dec. 11	5½	5½	Do. 5½ p.c. Deb.	102—107	...
152,600	Feb. 26	8	9	Guildford Cons.	110—120	...
54,055	,,	5	5	Do. 5 p.c. Pref.	90—95	...
68,250	Dec. 11	5	5	Do. 5 p.c. Deb.	90—95	...
156,600	Feb. 19	7	5	Hampton Court Cons. ...	75—85	...
86,046	June 19	‡4½	‡5	Holyh'd&N.W.G.&W.Cpn.Ord.	13/6—15/6	...
80,000	Feb. 12	4	4	Lea Bridge 4 p.c. Pref.	65—75	...
60,000	,,	6	6	Do. 6 p.c. Pref.	105—115	...
94,876	Dec. 18	4	4	Do. 4 p.c. Deb.	80—85	+5
73,620	Mch. 18	8¾	8¾	Luton Cons. 'A'	115—125	...
107,960	Feb. 26	4	5½	Mid Kent Ord. (£10)	7½—8½	...
230,940	Feb. 5	10	10	Oxford & District Ord. ...	135—145	...
47,112	,,	5	5	Do. 5 p.c. Pref.	85—90	...
50,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	100—105	...
126,193	Oct. 30	7½	7½	Peterborough Ord.	140—150	...
64,990	Mch. 18	7	7	Redditch Ord.	100—110	...
166,850	Feb. 19	8	8	Romford Ord.	108—118	...
60,000	,,	4	4	Do. 4 p.c. Pref.	85—90	...
44,000	Mch. 18	5	5	Do. 5 p.c. Deb.	97—102	...
25,570	Feb. 12	5½	5½	Rugby 5½ p.c. Pref.	95—105	...
25,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	100—105	...
42,750	De ,, 11	5½	5½	Do. 5½ p.c. Deb.	103—108	...
110,950	Feb. 26	8	8	Ryde Ord.	100—110	...
270,086	Mch. 18	7	7	Slough Ord.	98—103	...
21,000	Dec. 11	5	5	Do. 5 p.c. Deb.	92—97	...
28,872	Nov. 6	5½	5½	S. Midland Gas Cpn. Ltd. Ord.	14/—16/-	...
28,866	Mch. 18	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	14/—16/-	...
127,228	Feb. 19	5	7	Swindon Cons.	75—80	...
60,425	Dec. 18	5	5	Do. 5 p.c. Deb.	92—97	...
64,380	,,	5	5	Torquay & Paignton 5 p.c. Pref.	82—87	...
130,000	Feb. 12	5	5	Wakefield Ord.	85—95	...
81,650	,,	5	5	Do. 5 p.c. max.	75—80	...
82,000	Jan. 29	6	6	Weymouth Ord.	82—87	...
273,626	Feb. 12	7	7	Wolverhampton Cons. Ord. ...	115—120	-2½
98,384	,,	6	6	Do. 6 p.c. Pref.	105—115	...
160,000	Dec. 18	5½	5½	Do. 5½ p.c. Red. Deb. ...	100—105	...
106,490	Mch. 18	5½	5½	Wrexham Ord	75—85	...
90,000	Dec. 18	5	5	York 5 p.c. Red. Deb.	95—100	...
133,640	Feb. 19	6	6	Yorktown (Cam.) 5 p.c. Cons.	82—87	...
120,000	,,	5	5	Do. 5 p.c. Pref.	85—90	...
35,000	Dec. 18	5½	5½	Do. 5½ p.c. Deb.	103—108	...

BRISTOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 12.	Rise or Fall on Week.
347,756	Feb. 12	5	6	Bath Cons.	102—105	...
1,667,250	Feb. 5	5	5	Bristol, 5 p.c. max.	104—106	...
120,420	Dec. 18	4	4	Do. 1st 4 p.c. Deb.	98—101	...
415,250	,,	4	4	Do. 2nd 4 p.c. Deb. ...	98—101	...
328,790	,,	5	5	Do. 5 p.c. Deb.	115—117	...
274,000	Feb. 26	5	5	Newport (Mon.) Ord.	91—94	...
13,200	Mch. 26	7	8½	Pontyp'l Gas & W. 10 p.c. 'A'	11¾—12½	...
13,600	,,	5	6	Do. 7 p.c. 'B'	10½—10¾	...
40,000	,,	5	6	Do. 7 p.c. 'C'	10½—10¾	...
140,778	Feb. 12	5	5	Weston-super-Mare Cons. ...	92—96	...
64,338	Dec. 27	4	4	Do. 4 p.c. Deb.	90—95	...
33,340	,,	7½	7½	Do. 7½ p.c. Deb.	140—150	...

LIVERPOOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 12.	Rise or Fall on Week.
157,150	Feb. 5	5	6½	Chester 5 p.c. Ord.	98—101	...
92,500	Dec. 18	4	4	Do. 4 p.c. Pref.	80—84	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb.	85—88	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	95—99	...
2,167,410	Feb. 19	6	6	Liverpool 5 p.c. Ord.	106—108	+1
245,500	Dec. 18	5	5	Do. 5 p.c. Red Pref. ...	95—100	...
306,083	July 17	4	4	Do. 4 p.c. Deb.	99—101	...
106,280	Feb. 5	10	8	Preston 'A' 10 p.c.	165—175	...
188,219	,,	7	7	Do. 'B' 7 p.c.	123½—133½	...

NEWCASTLE EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 12.	Rise or Fall on Week.
122,577	Feb. 19	7	7	Blyth 5 p.c. Ord.	113—118	...
732,000	Feb. 19	4	4	Hartlepool G. & W. Cn. & New	63½—64½	...
2,430,267	Feb. 5	5	5 7/16	Newcastle & Gateshead Con.	20/3—21/-o	+-/4½
682,856	,,	4	4	Do. 4 p.c. Pref.	89—91	...
776,706	Dec. 27	3½	3½	Do. 3½ p.c. Deb.	84—86	...
277,285	April 24	5	5	Do. 5 p.c. Deb. '43 ...	102—104	+1
332,351	Feb. 5	6	6	Sunderland 6 p.c. max. ...	111—113	...

NOTTINGHAM EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 12.	Rise or Fall on Week.
542,270	Feb. 12	6	9	Derby Con.	103—108	...
55,000	Dec. 18	4	4	Do. 4 p.c. Deb.	98—103	...
20,000	Dec. 18	5	5	Long Eaton 5 p.c. Pref. ...	9—11	...
80,000	,,	5	5	Do. 5 p.c. Deb. ...	100—105	...

SHEFFIELD EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 12.	Rise or Fall on Week.
10,000	Feb. 19	10	10	Great Grimsby 'A' Ord. ...	170—180	...
6,500	,,	10	10	Do. 'B' Ord. ...	170—180	...
79,000	,,	10	10	Do. 'C' Ord. ...	160—170	...
1,806,339	Feb. 26	6½	6½	Sheffield Cons.	123—125	...
95,000	Jan. 2	4	4	Do. 4 p.c. Deb.	98—100	...

a The quotation is per £1 of Stock.
* Ex. div. ‡ For year.

INDEX TO "JOURNAL" ADVERTISERS

	PAGE
Alder and Mackay, Ltd.	150
Ascot Gas Water Heaters, Ltd.	Cover I
Ashmore, Benson, Pease, & Co., Ltd. ...	115
Bale & Church, Ltd.	157
Blakeley, Firth, Sons, & Co., Ltd.	157
Braddock, J. & J.	157
British Fittings Co. (Hendon), Ltd.	160
Broadbent. Thos., & Son, Ltd.	119
Brotherhood, Peter, Ltd.	125
Cellactite & British Uralite, Ltd.	116
Clayton, Son, & Co., Ltd.	Cover II
Cowan, W. & B.	Cover III
Crone & Taylor, Ltd.	Cover IV
Dempster, Robert, & Sons, Ltd. ...	...138, 157
Donkin Co., Ltd. (The Bryan) ...	Cover II
Ellison Insulations Ltd.	157
Falk, Stadelmann & Co., Ltd.	117
Gas Meter Co., Ltd.	Cover IV
Gas Purification and Chemical Co., Ltd. ...	157
Glover, Thos., & Co., Ltd.	126
Harris & Pearson, Ltd.	Cover IV
Harvey, G. A., & Co. (London), Ltd.	115
Holmes, W. C., & Co., Ltd.	159
Horden Collieries, Ltd.	160
Humphreys & Glasgow, Ltd.	124
Jenkins, W. J., & Co., Ltd.	121
Johnson, C. H., & Sons, Ltd.	158
Keith Blackman, Ltd.	160
King, Walter, Ltd. 117,	156
Kleenoff Co.	157
Le Bas Tube Co., Ltd.	123
Main, R. & A., Ltd.	146
Mewburn, Ellis, & Co.	157
Oxley Engineering Co., Ltd.	119
Parkinson Stove Co., Ltd.	143
Parkinson, W., & Co.	126
Pass, E., & Co.	155
Peebles & Co., Ltd.	120
Philplug Products, Ltd.	117
Potterton, T. (Heating Engineers), Ltd. ...	155
Radiation, Ltd.	...144, 145
Reavell & Co., Ltd.	156
Slingsby, Walter, & Co., Ltd.	117
South Hetton Coal Co., Ltd.	156
South Metropolitan Gas Company	151
Spencer (Melksham) Ltd.	114
Strachan & Henshaw, Ltd.	157
Sutcliffe, Speakman & Co., Ltd.	123
Technological Institute	157
Trotter, Haines, & Corbett, Ltd.	157
Turbine Furnace Co., Ltd.	114
Visco Engineering Company, Ltd.	122
Walker, C. & W., Ltd.	122
Watkins & Watson, Ltd.	157
Wells, A.C. & Co., Ltd.	114
West's Gas Improvement Co., Ltd.	152
Willey & Co., Ltd.	118
Woodall-Duckham Co., Ltd.	137
Wright, Alex., & Co., Ltd.	113
Appointments Vacant and Wanted ...	...157, 158
Contracts Open	158
Educational	157
Patents	157
Plant, &c.	157
Plants, &c., Wanted and for Sale	157